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JULY 1954

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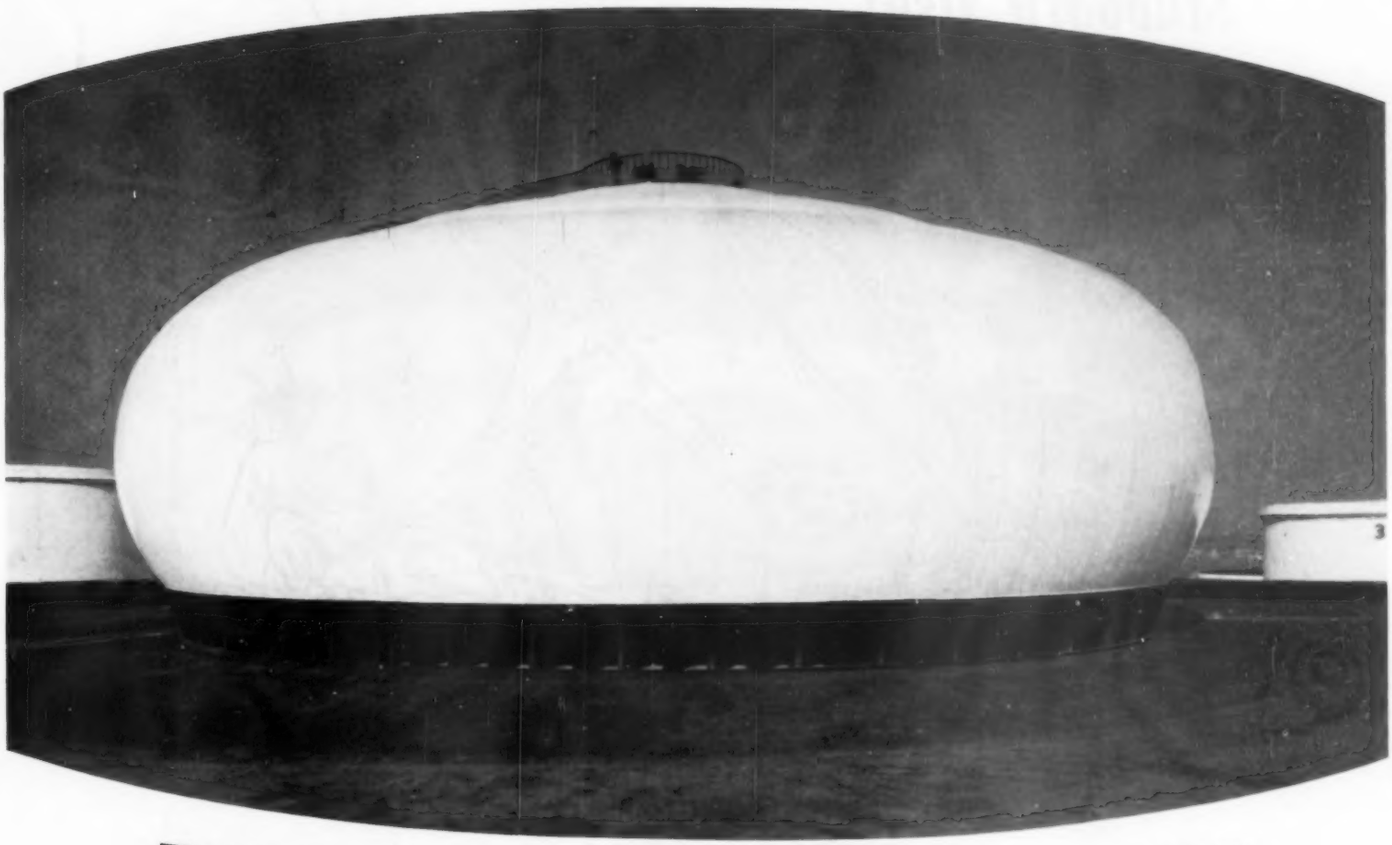

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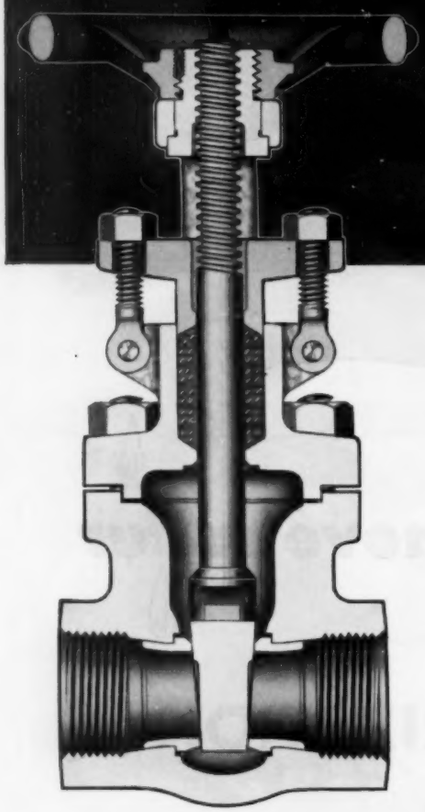

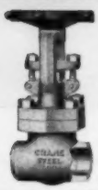

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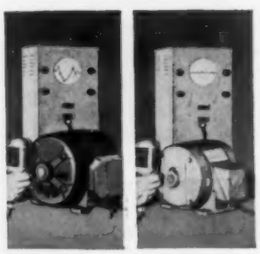

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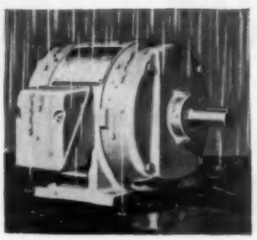

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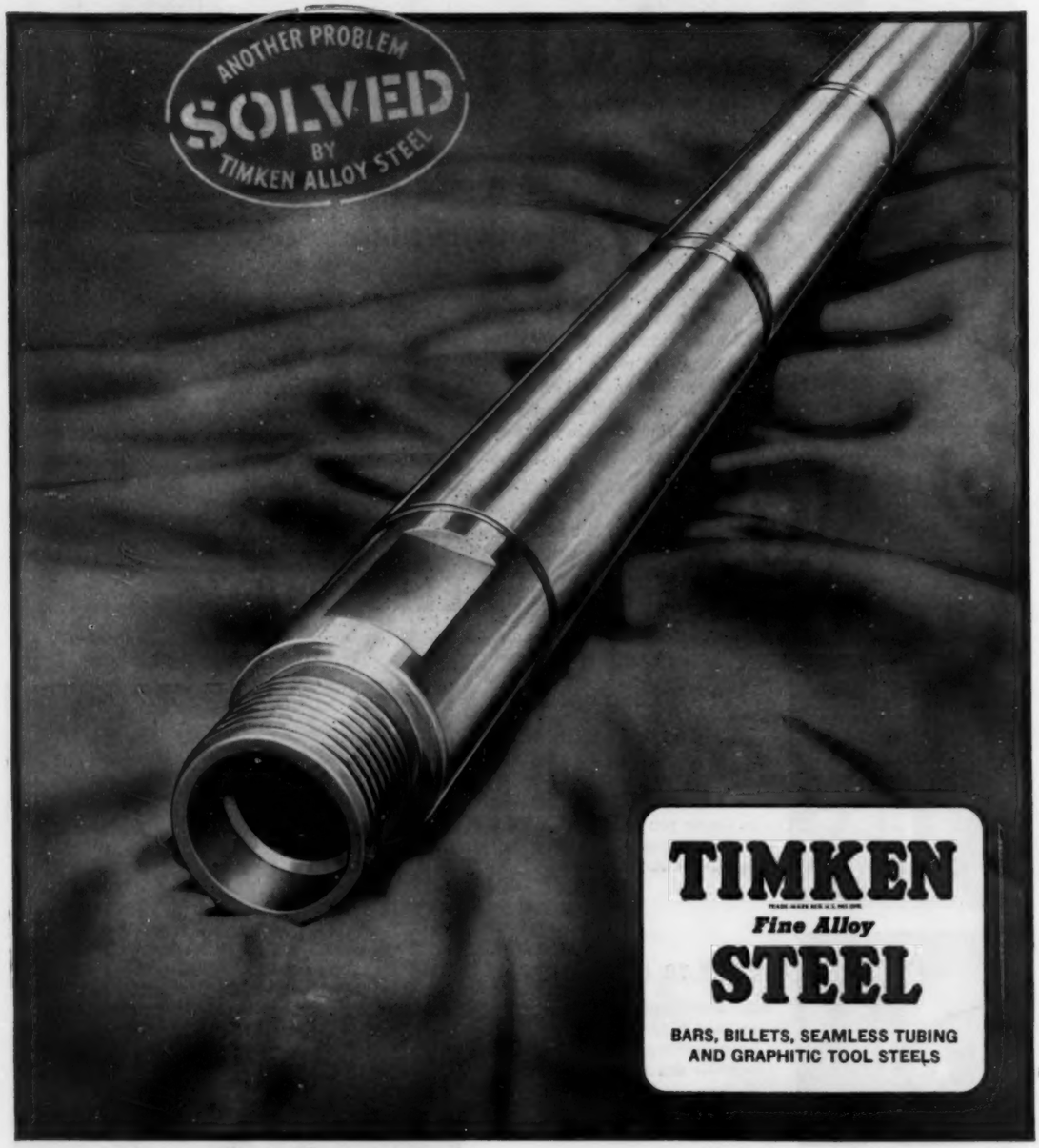

Washington PIPE LINE

Decision on natural gas

By Joseph B. Huttlinger

THE UNITED STATES CONGRESS will be asked to settle once and for all next year whether it wants independent producers of natural gas freed of federal regulations.

This was forecast by officials of the natural gas industry on the strength of assurances by a number of leaders of both the House and the Senate of all-out support in the drive for such legislation.

The only question, since the Supreme Court handed down its opinion in the case of the Phillips Petroleum Co., was whether to try for legislation this year on next.

Senator Lyndon Johnson (D., Texas), who believes the 2,300 independent gas producers who are not linked to interstate pipe lines should continue free of government controls as they always have, made the comment on the timing. He expressed the hope that the Eisenhower administration would confer with officials of the states and the industry and present a formal recommendation for action to Congress by January of next year.

The Federal Power Commission, which is directed by the high court's opinion to exercise control over prices of gas of independent producers at the wellhead, is expected to do nothing in this direction before next year. This is because any action would call for hearings and fact-findings about cost, which would be time-consuming.

The time pressure springs, however, from the fact that independent producers may be reluctant to sell gas to pipe line companies in the face of the court's opinion. Unless or until there is legislation making clear that he does not come under federal control, the producer would have no assurance of finally receiving the price he might agree to sell for.

The high court, in its five to three decision, went much further than most persons had expected, although it had been widely believed the tribunal would suggest some controls over natural gas sales and prices in the gathering area. In effect, however, the court called for federal control at the wellhead.

The effect of the court's ruling is especially broad at this time, as there is lively competition for gas and the price has been mounting step by step.

The majority opinion was written by Associate Justice Sherman Minton. He was joined by Chief Justice Earl Warren and Associate Justices Hugo L. Black and Stanley F. Reed. Associate Justice Felix Frankfurter wrote a separate concurring opinion.

The Minton opinion read in part:

"We believe that the legislative history indicates a Congressional intent to give the Commission jurisdiction over the rates of all wholesales of natural gas in interstate commerce, whether by pipe line company or not and whether occurring before, during or after transmission by an interstate pipe line company.

"Thus, we are satisfied that Congress sought to regulate wholesales of natural gas occurring at both ends of the interstate transmission systems."

The 12-page opinion wound up in this way:

"Regulation of the sales in interstate commerce for resale made by a so-called independent natural gas producer is not essentially different from regulation of such sales when made by an affiliate of an interstate pipe line company.

"In both cases, the rates charged may have a direct and substantial effect on the price paid by the ultimate consumers.

"Protection of consumers against exploitation at the hands of natural gas companies was the primary aim of the Natural Gas Act. Attempts to weaken this protection by a mandatory legislation exempting independent natural gas producers from federal regulation have repeatedly failed and we refuse to achieve the same result by a strained interpretation of the existing statutory language."

Associate Justices Tom C. Clark and Harold Burton held in a dissenting opinion that independent producers, under the law as written, are clearly free of federal regulation. Associate Justice William O. Douglas wrote a separate dissenting opinion.

The Clark-Burton dissent said:

"On its face, this language (of Justice Minton) brings every gas operator, from the smallest producer to the largest pipe line, under federal regulatory control.

"By today's decision, the court restricts the phrase 'production and gathering' to the 'physical activities, facilities and properties' used in production and gathering. Such a gloss strips the words of their substance. If the Congress so intended, then it left for state regulation only a mass of empty pipe, vacant processing plants and thousands of fallow wells with scarecrow derricks, monuments to this new extension of federal power."

For their part, the dissenters held: "Language could not express a clearer command, but the majority renders this language (of the Natural Gas Act) almost entirely nugatory by holding that the rates charged by a wholly independent producer and gatherer may be regulated by the Federal Power Commission."

In his dissent, Justice Douglas said the Natural Gas Act calls for regulation of gas sold in interstate commerce for resale, but exempts from control production and gathering of natural gas.

Thus, two provisions of law apply, and "we must make a choice." He chose to exempt production, he wrote, explaining:

"The fastening of rate regulation on the independent producer brings 'the production or gathering of natural gas' under effective federal control, in spite of the fact that Congress has made that phase of the natural gas business exempt from regulation.

"The effect is certain to be profound. The price at which the independent producer can sell his gas determines the price he is able or willing to pay for it, if he buys from other wells. The sales price determines his profit, and his profit and the profits of all the other gatherers whose gas moves into the interstate pipe lines have profound effects on the rate of production, the methods of production, the old wells that are continued in production and the new ones explored.

"Regulating the price at which the independent producer can sell his gas regulates his business in the most vital way any business can be regulated. That regulation largely nullifies the exemption granted by Congress."

The high court's opinion is the latest of a series in the past few years spelling out the court's ideas on the meaning of the Natural Gas Act. In the past, the high court has held that a state may set a minimum price at which gas can be sold, but the court is yet to say who prevails if a federal authority sets a lower price. The court has held that the gas act applies to distribution of gas within a single state in a case involving the East Ohio Gas Co., and the Congress acted only this year to overturn the court by an amendment to the act exempting such distribution. The details of exempting companies from the FPC regulation under this act, the Hinshaw bill, are being worked up by the FPC.

All in all, the Phillips decision of the high court presents clearly the issue of regulation of independent gas producers. In the past it has been argued that the gas act can mean anything. Now that the court has spoken, the producers insist that if they are to have a fair return from their sales, they must get legislation through the Congress.

Chances appear excellent for such legislation, but not until next year. This is election year for one thing, and there are more consumers of gas to vote than there are producers. For another, the session is drawing near its close, and Congress hesitates to risk a filibuster at the end that might tie up both the legislation and adjournment.

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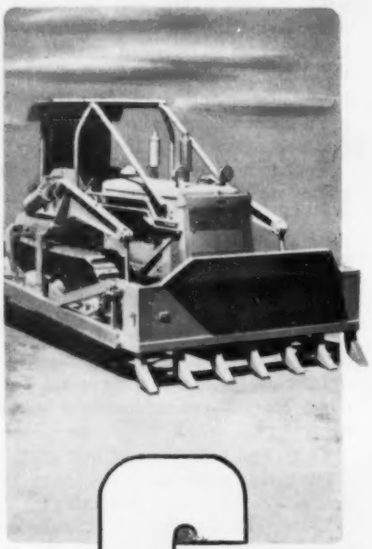

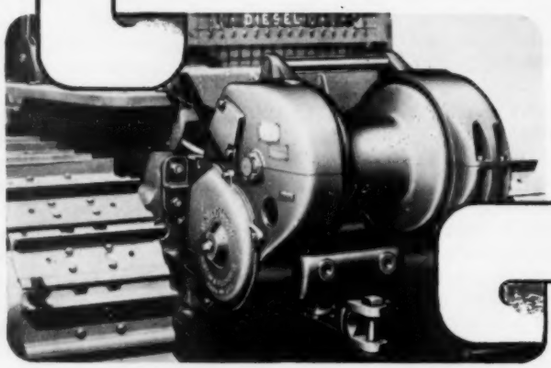

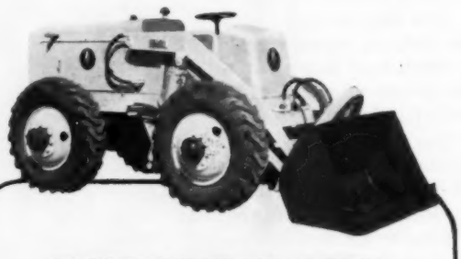

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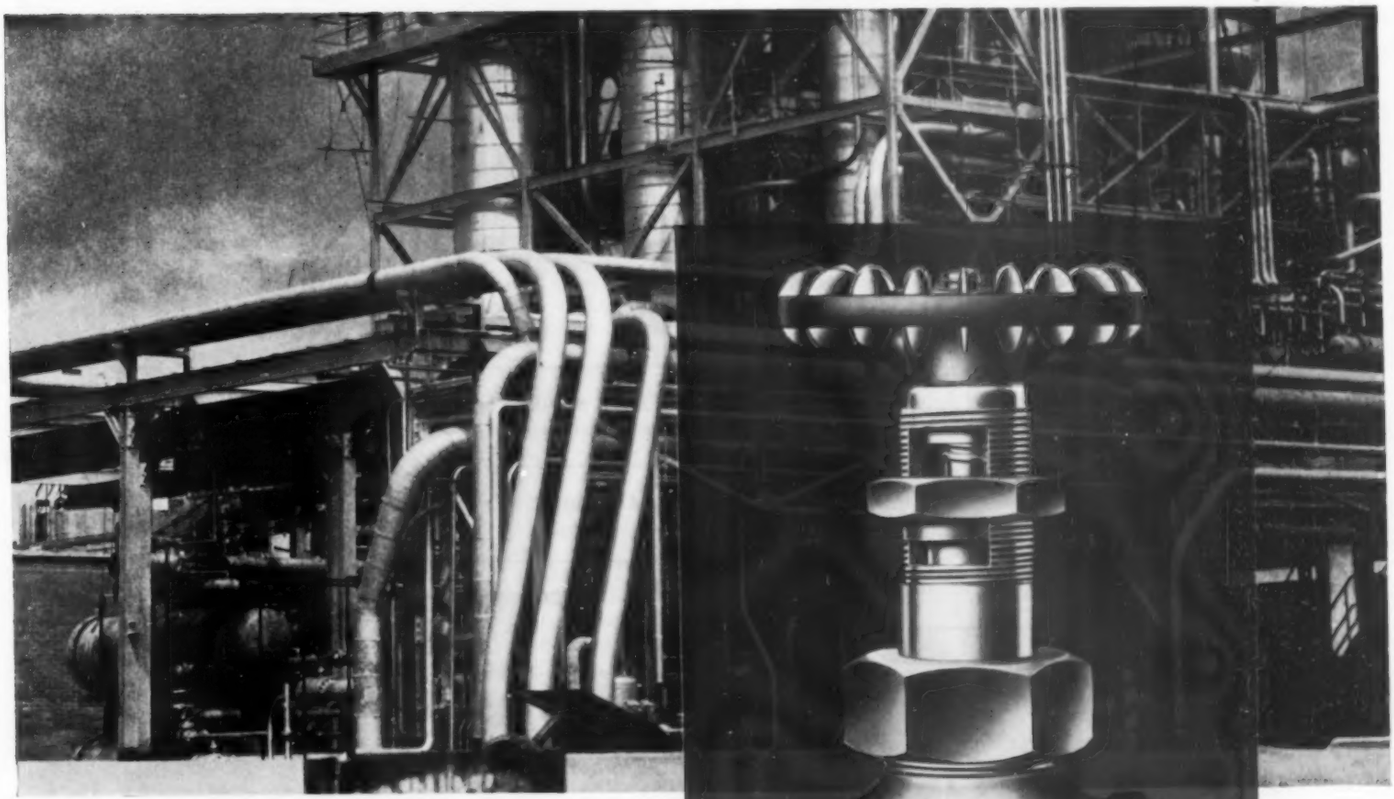

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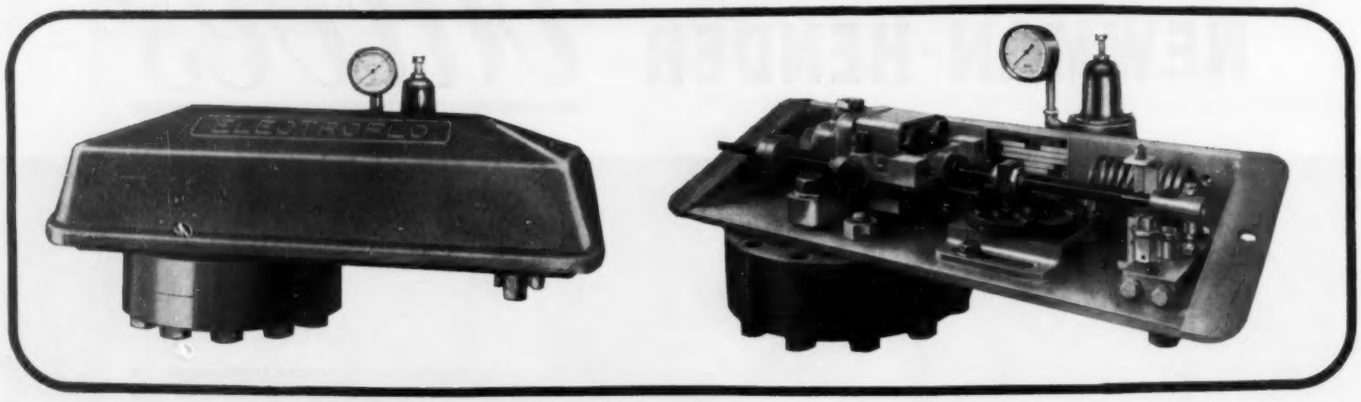

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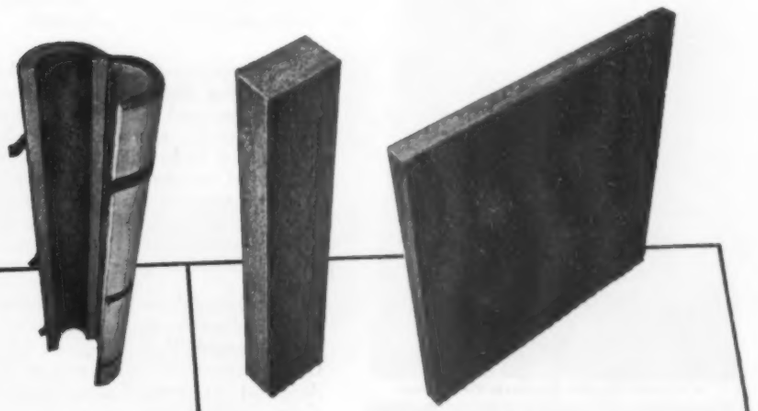

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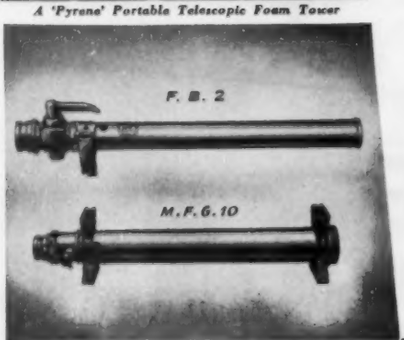

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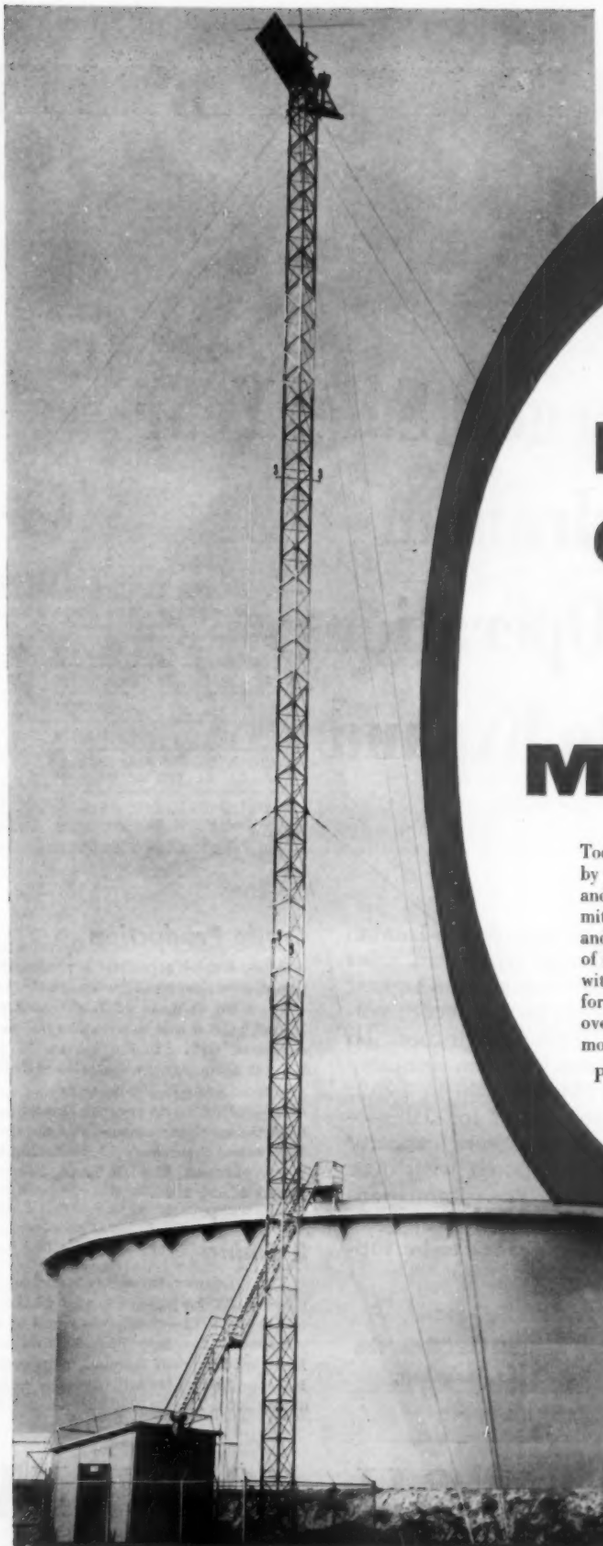
'Pyrene' Pump-type, CO_2, and Dry Chemical Extinguishers, and 'Phomene' Chemical Foam Extinguisher



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1953

Second Largest Sales Year for Anglo-Iranian as World Operations Continue to Expand

1953 was marked by a growing rate of expansion in Anglo-Iranian operations. In the second full year without oil from Iran, sales were 14 per cent over 1952 and achieved their second highest level in company history, being exceeded only by the record volume of 1950 with full production in Iran. To maintain its position in the face of severe competition in world markets, the company has made heavy capital expenditures—$160,000,000 in 1952; $210,000,000 in 1953; $168,000,000 scheduled for 1954—chiefly for refineries. By the end of 1955, total refining capacity should be nearly 610,000 barrels a day, compared with over 406,000 barrels last year and 640,000 in 1950. The commissioning of Aden refinery on the Red Sea and Kwinana refinery in Western Australia will enable markets East of Suez to be supplied more economically.

Copies of the Annual Report and Accounts may be obtained from the Company's Purchasing Agent in U. S. A., Mr. J. E. Anderson, 610 Fifth Avenue, New York 20, N. Y.

Crude Production

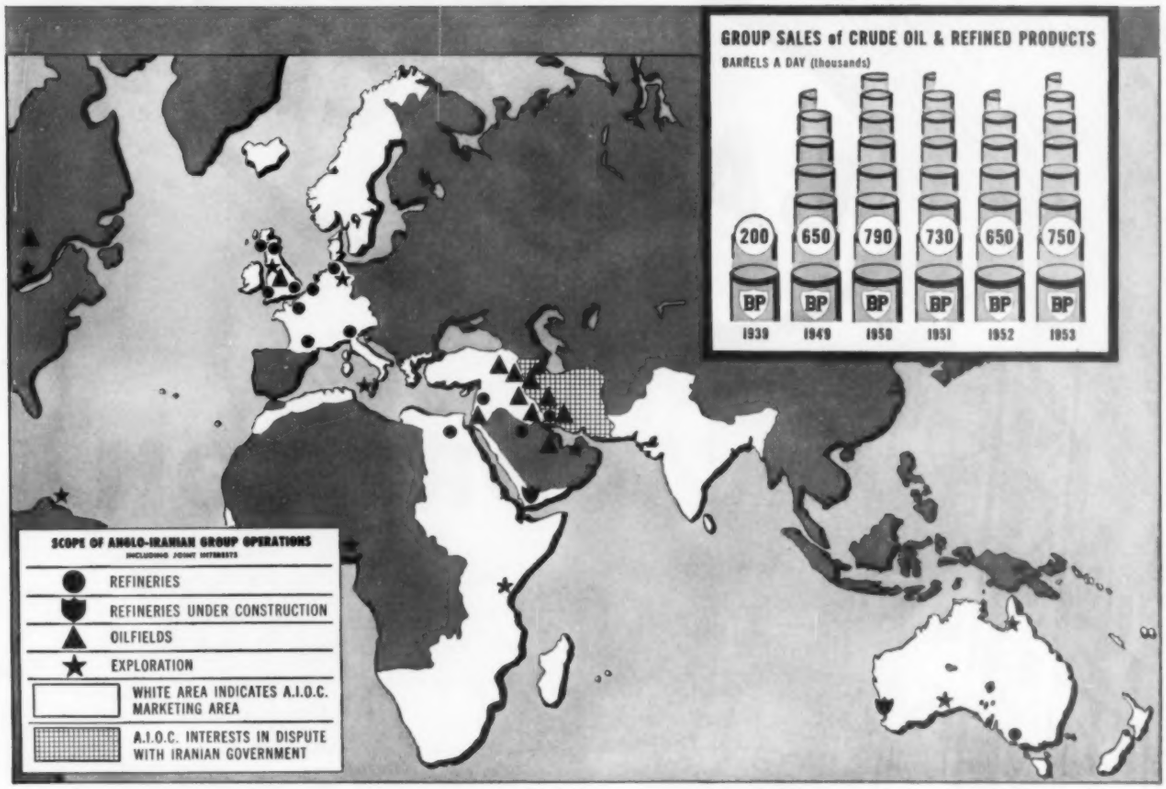
Anglo-Iranian's crude oil production in the Middle East was substantially higher in 1953, when its daily offtake from Kuwait, Iraq and Qatar rose to some 654,000 barrels compared with 519,900 barrels in 1952. Kuwait again was the major source of supply, providing 473,500 barrels daily against 402,500. Production began in February 1953 from the northerly extension of the Burgan field where there were 22 producing wells by the year-end, 13 wells having been completed during 1953.

Refining

Total refinery throughput during 1953 was 406,200 barrels daily, over 40,600 barrels above 1952—chiefly the result of commissioning the new 80,000 barrel-a-day Kent refinery near London. Antwerp and Hamburg refineries will increase capacity during 1954. The 120,000 barrel-a-day Aden

ANGLO-IRANIAN OIL COMPANY,

BRITANNIC HOUSE · FINSBURY CIRCUS · LONDON · E.C. 2



refinery, four months ahead on construction, should come on stream in August and the 60,000 barrel-a-day Kwinana (Australia) refinery early in 1955.

Exploration

The search for oil continues—in Australia, Canada, Britain, Sicily, Nigeria, Tanganyika, Zanzibar, Trinidad, Papua and the Persian Gulf. Anglo-Iranian has acquired an interest in Triad Oil Company which has well spread holdings in Western Canada. In Papua, a test well at Omati has encountered high pressure gas at 13,743 feet. In Sicily, a test well at Vittoria is below 7,000 feet, with oil indications. Underwater drilling is to be started off Trinidad this year and exploration in the Persian Gulf has begun.

Tankers

Anglo-Iranian's tanker fleet now totals 142 ships of 1,917,000 deadweight tons, compared to 151 ships of 1,934,000 deadweight tons a year ago. While slightly smaller in number and tonnage, the present fleet can carry a larger total tonnage more economically due to the increased proportion of larger, faster and newer ships. The Company's 28,000 and 32,000 ton tankers are proving particularly efficient as carriers of crude from the Middle East. Under construction or on order are 20 ships totalling 474,000 deadweight tons, including 10 of 32,000 tons. In addition, over 2,000,000 deadweight tons continue on charter.

Iran

Two sets of negotiations are progressing to settle the oil dispute in Iran—one on the part of a proposed consortium of American, British, Dutch and French oil companies, the other involving the question of compensation to Anglo-Iranian. Pending a satisfactory conclusion, Anglo-Iranian has continued with all necessary legal action to protect its rights in oil cargoes derived from the area of its operations in Iran and exported overseas.

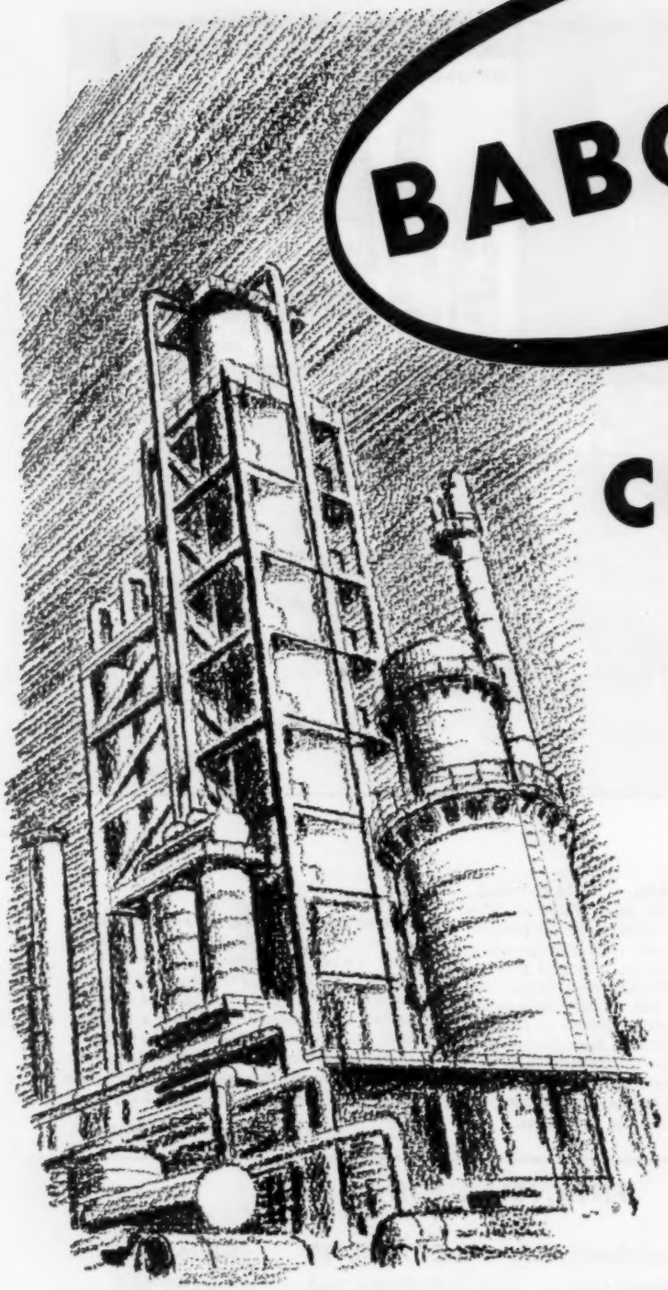
(Barrel figures used are approximate)

LIMITED

FINANCIAL HIGHLIGHTS

	1953	1952
Gross Consolidated Profit	£63,883,828	£61,260,584
Depreciation	£20,056,243	£14,198,946
Profit Before United Kingdom Taxation	£42,931,666	£47,061,638
Net Profit to AIOC	£24,382,850	£25,165,966
Dividends	£ 9,629,672*	£ 8,119,359

* Including recommended final dividend and cash bonus



BABCOCK

at

CORYTON

Babcock & Wilcox Ltd. are playing a vital part in the provision of British-made equipment for Britain's new oil refineries. Their contribution to the new Coryton refinery is a major one, comprising *98 pressure vessels and 30 vertical columns*, for incorporation in the furfural, propane, deasphalting, M.E.K., distillation, percolation and T.C.C. units, and in connection with gasolene treatment, yard piping air supply, propane tankage, thermal reformation and boiler plant. The T.C.C. unit includes a Reactor weighing 60 tons, in size, 47 ft. by 13 ft., fabricated from "Colclad"—alloy-clad steel. Total weight of all these items is over 800 tons; and the vertical columns range in height up to 92 ft.

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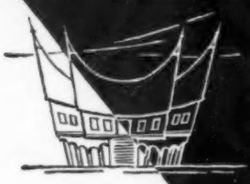
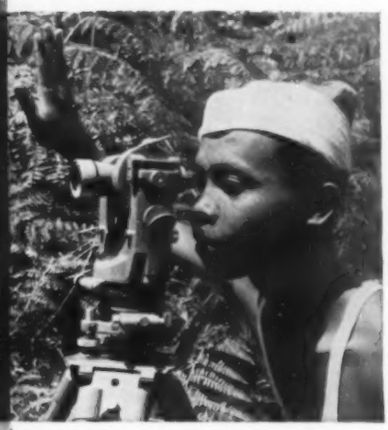
HOLLAND—Typical of Holland's modern transportation facilities is the "Koningin Juliana." This palatial Diesel-powered ferry carries 75 automobiles and trucks and 2,000 passengers between the islands of Zeeland province. The "Koningin Juliana" is lubricated exclusively with Caltex products. Caltex is proud of its share in such advances in the transportation system of this historic land.

INDONESIA—Exploring and drilling for oil in the Minas field, Caltex employs mostly nationals, a Caltex policy in all lands. Men—like this surveyor's helper—are trained in the many skills required by the oil industry, all of which give higher income opportunities. The Republic of Indonesia benefits through development of its resources, producing new government revenues.





SOUTH AFRICA—Fabulous land of gold and diamonds, South Africa is experiencing vigorous growth and modernization. Here in the shadow of the famous "Table Mountain" is the warehouse area of the Caltex Cape Town terminal—storage place for the fine fuels and lubricants for increasing numbers of motorists who "Travel the Caltex Way."

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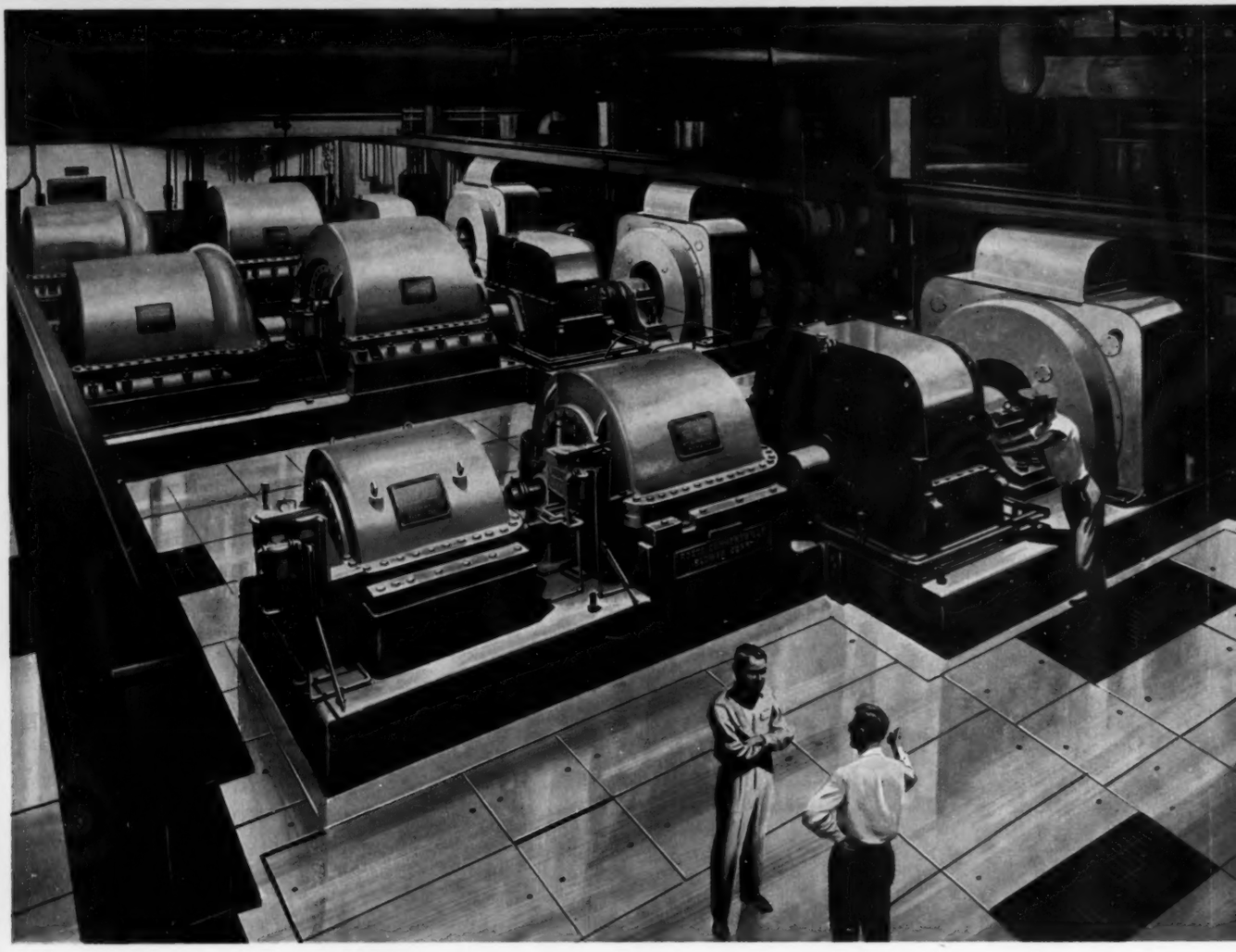

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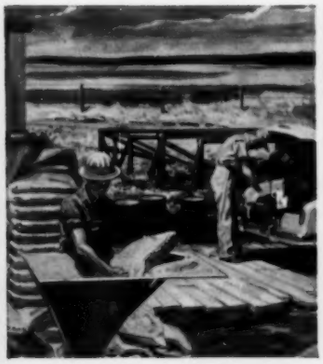

MAGNET COVE BARIUM CORP., Houston, Tex., Malvern, Ark. Magcobar drilling mud, Magcogel bentonite, Mylojel, Fiber Seal, Jel-Oil mud.

CLARK BROS. CO. DIVISION, Olean, New York. Engines and compressors—gas, steam and diesel driven.

DRESSER MANUFACTURING DIVISION, Bradford, Pa. Oil and gas pipe couplings, fittings and sleeves—rolled and welded rings—welded fittings and flanges.

KOBE, INC., DIVISION, Huntington Park, Calif. Complete hydraulic oil field pumping systems, including the Kobe Free Pump.

No. 8 in a series about Dresser Industries

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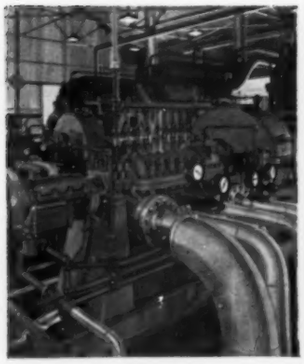
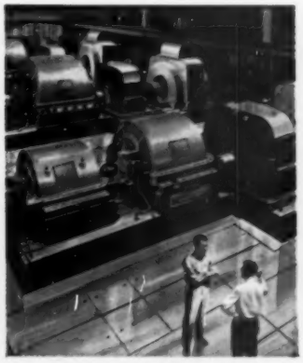


PACIFIC PUMPS, INC., Huntington Park, Calif. Centrifugal pumps, deep oilwell plunger pumps, hot oil and boiler feed pumps.



ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind. Rotary positive blowers, gas pumps, centrifugal blowers, exhausters; positive displacement meters.

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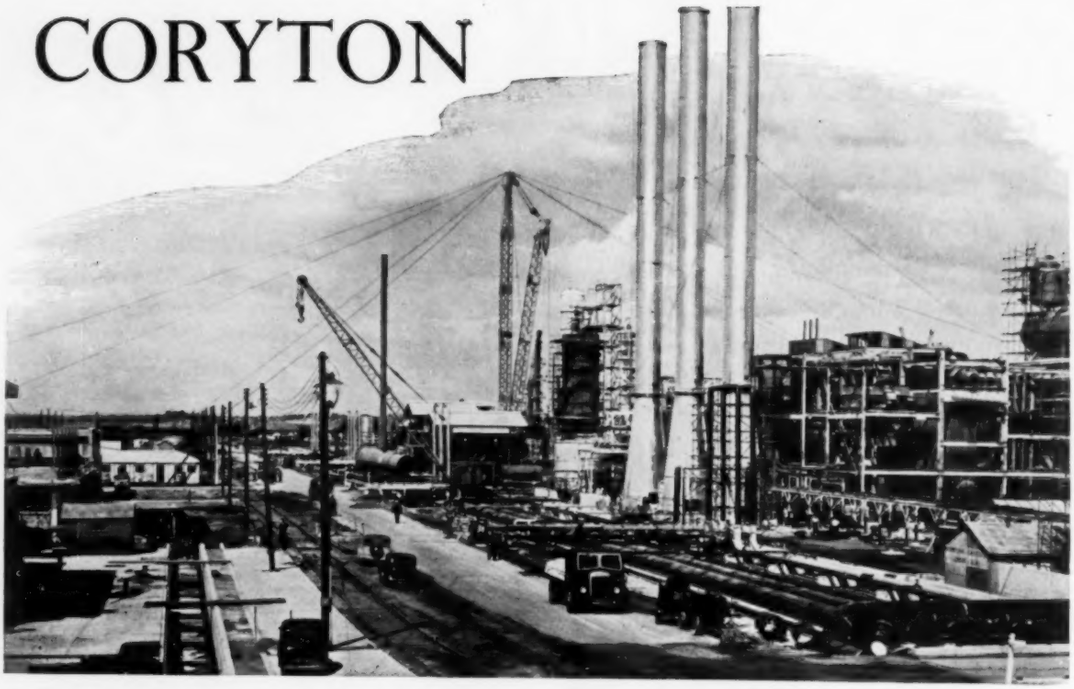

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Turbo-Generator Sets Three Metrovick 5,000 kW, pass-out type condensing turbo-generator sets are to be installed. The single cylinder turbines, which are supplied with steam at 600 psig 735° F., are so designed as to pass-out steam at 140 psig and 20 psig. Under certain conditions, provision is made for steam at 20 psig to be passed-in to the turbine.

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Non-Flameproof motors Two Metrovick 200 hp, 740 r.p.m., vertical motors were supplied for driving water pumps.
These motors (both flameproof and non-flameproof types) are squirrel-cage induction machines connected to a 3.3 kV three phase, 50 cycle supply.

METROPOLITAN-VICKERS
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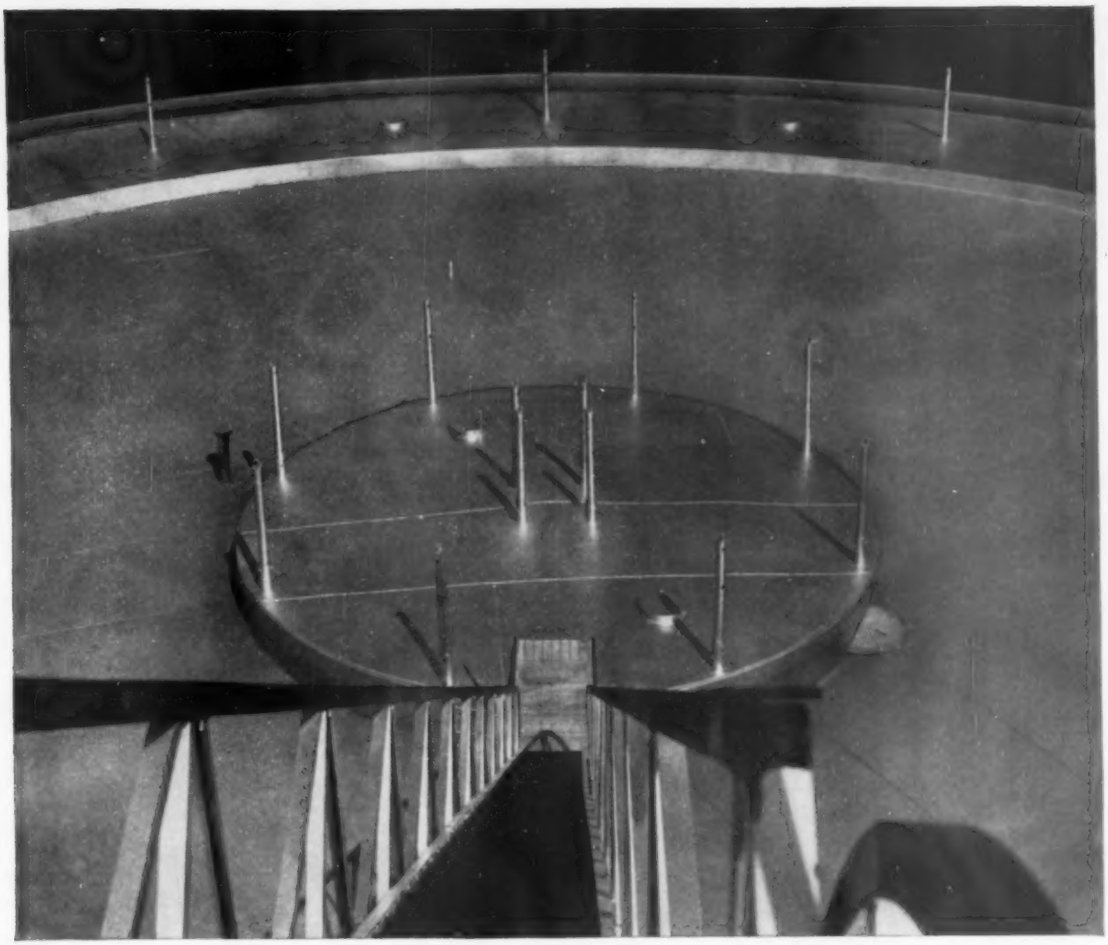

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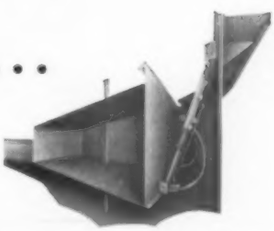
into a Graver Center-Weighted "Floater." It's a well-built tank especially designed to conserve volatile vapors by means of Graver's own "Vapor-Stop" Seal—the improved seal which maintains firm closure between the floating roof and the shell. This patented Graver seal mechanism is an integral part of all Graver Floating Roof designs. It is flexible, yet firm—tight, yet responsive. It provides centering action for the roof and prevents the entrance of air and rain. From time to time you may expect similar technological improvements from Graver . . . where increasing emphasis will continue to be placed on research and development.



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The above pictures illustrate Dean Smith & Grace lathes installed at the CORYTON REFINERY ESSEX and are reproduced by the kind permission of the VACUUM OIL COMPANY.

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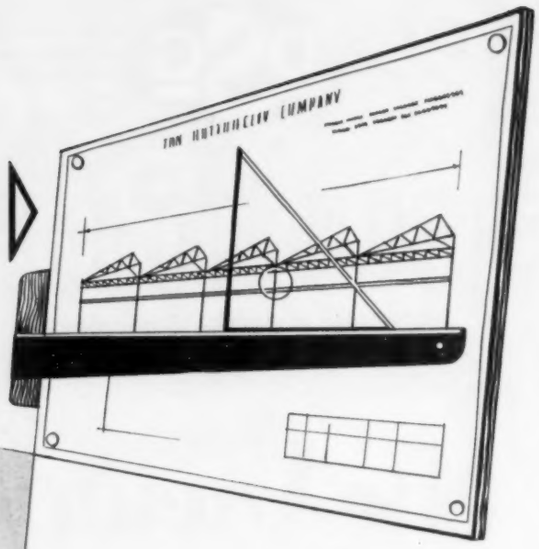

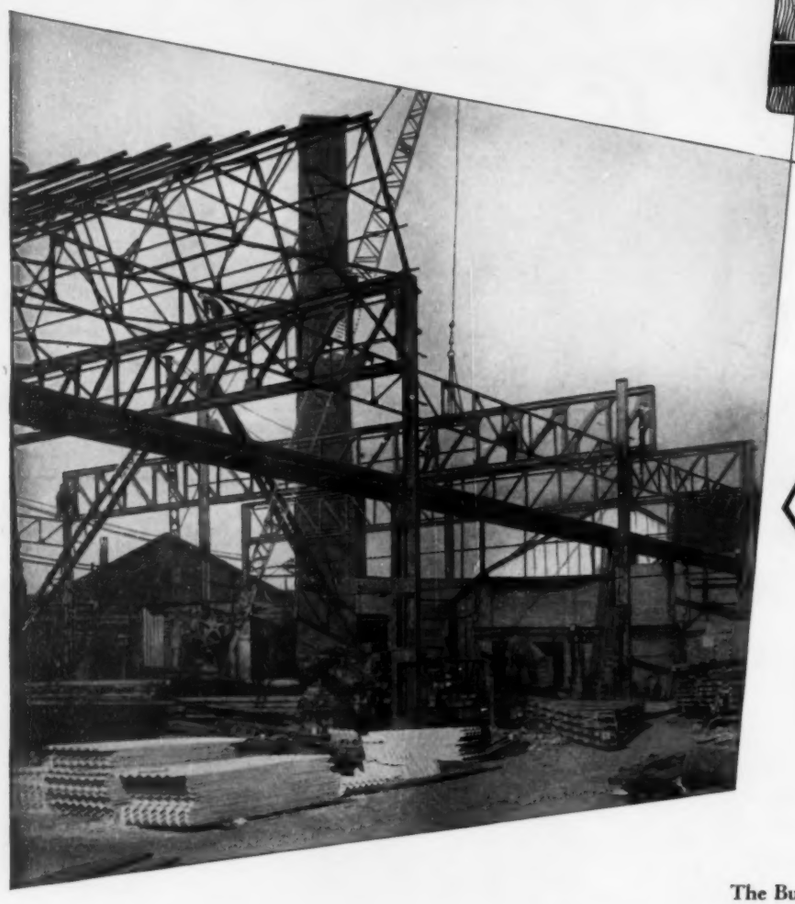

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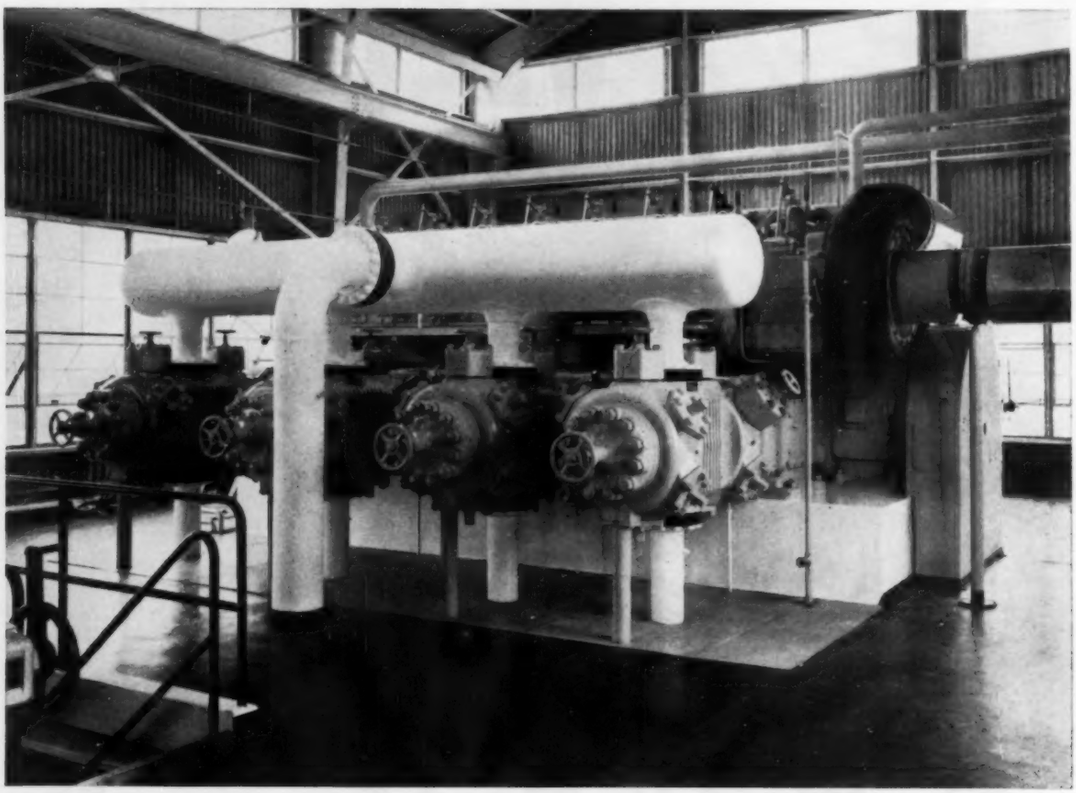
FLYING A

New Clark Turbocharged Compressor on Tennessee Gas Transmission Pipeline shows improved operating economy



The simple, clean-cut design of both turbocharger and compressor is shown in this view of Tennessee Gas Transmission Co.'s TRA-8 installation. Both the new Turbocharger and Gas-Engine-Driven Compressor were designed and built by Clark as matching units.

Substantial savings in fuel, cooling water, foundation and installation realized

IT'S only natural that the Tennessee Gas Transmission Company, one of the largest capacity major trunk line systems in the country and also one of the most progressive in the field, should be among the first to install a new Clark Turbocharged Compressor.

TGT'S 99TH CLARK UNIT

The new unit, a Model TRA-8, was placed alongside 26 Clark "Big Angles" in TGT's Middleton, Tennessee compressor station, making it the 99th Clark Compressor in the Company's vast system.

FUEL CONSUMPTION LOWERED

That was back in February. What has happened since is important news for the whole industry. From the day the unit was first placed on stream at its rated 1320 BHP load, it has met or exceeded all expectations. Fuel consumption is considerably less than on units not turbocharged, checks by engineers showed. There have been no forced mechanical shutdowns. Only the usual minor adjustments which occur on any new piece of equipment were made.

RECORD ANTICIPATED BY CLARK

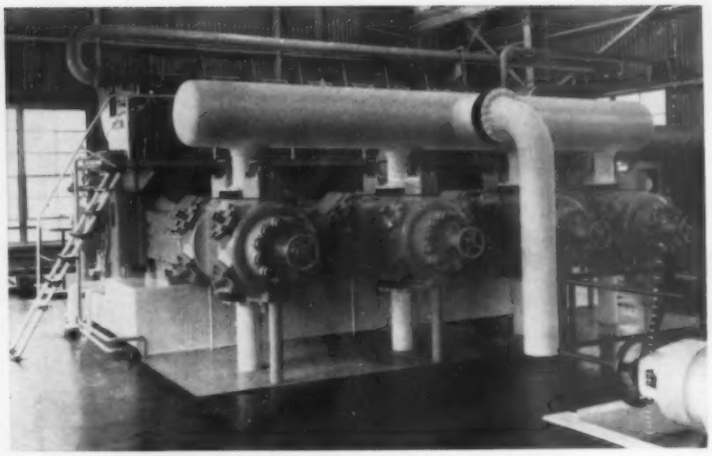
Of course, performance records such as this were not unexpected. According to Clark engineers, the TRA and TLA were specifically *designed* from the ground up as turbocharged, 2-cycle, gas-engine-driven compressors with all components perfectly matched. They were *designed* to burn 10 to 12½% less fuel, to require 40% less cooling water and to deliver considerably more power in 25 to 30% less floorspace than comparable non-turbocharged compressors.

BIG BOON TO OPERATING ECONOMY

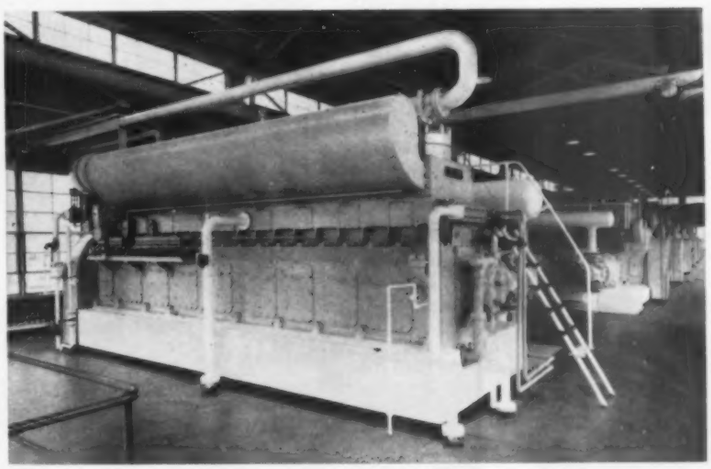
With operating economies more essential today than at any time in history, the new TRA and TLA have already proved to be one of the most practical means of decreasing compressor operating and installation costs per bhp, according to Clark engineers.

NEW LITERATURE PUBLISHED

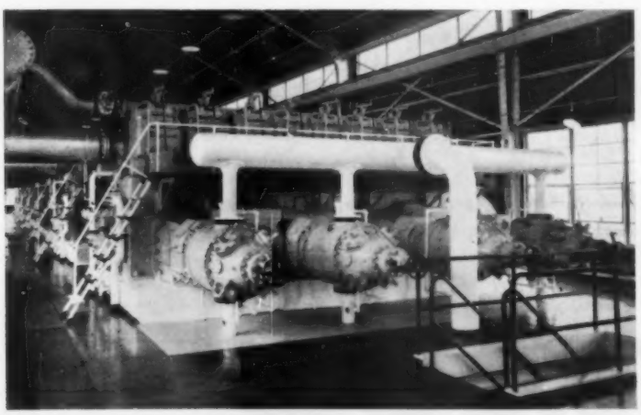
Clark Turbocharged Compressors are built in the 825-3300 BHP range. Bulletins 130 and 134, describing Models TRA and TLA respectively, are available by writing Clark Bros. Co., Division of Dresser Operations, Inc., Olean, New York.



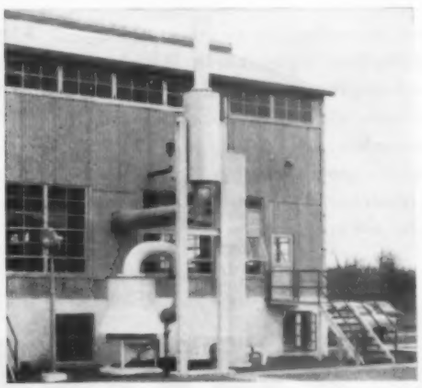
Tennessee Gas Transmission Co.'s TRA-8 is equipped with four Clark air cooled pipeline type compressor cylinders.



Minimum of piping required for Clark Turbocharged Compressor is exhibited in this view of the TRA-8, from the exhaust manifold side, at Tennessee Gas Transmission Co.'s Middleton station.



The Clark TRA-8 along with 7 Clark HBA-8 Compressors is housed in this Tennessee Gas Transmission Co. building. A total of 26 Clark "Big Angles" are housed in three buildings at the Middleton, Tenn. station.



Exterior of compressor building shows the simplicity of Clark Turbocharged Compressor installation. Notice that only one air inlet pipe, one exhaust pipe, one muffler and one air cleaner are required.

Many processes are available to the refiner who is projecting a refinery from a given crude. The selection of these various processes at each step of the way is obviously important — both economically and to meet required product specifications.

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VOL. 25. NO. 7. JULY 1954

World Petroleum

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THIS MONTH'S COVER

Where the Mississippi meets the Gulf of Mexico, thousands of acres of swamp and jungle can be explored by oil company geophysicists only with the aid of such weird vehicles as the swamp buggy and the helicopter. Photograph is by Leon Trice of New Orleans for The California Co. Color plates are reproduced here through the courtesy of C. R. Lyman, editor of *The Bulletin*, house magazine of The Standard Oil Co. of California.

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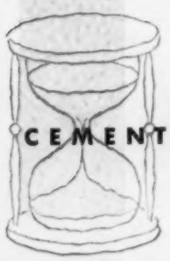
point up HALLIBURTON'S
2,000,000 job experience



HALLIBURTON OIL WELL CEMENTING COMPANY
DUNCAN, OKLAHOMA

Depletion Allowance Vital To Reserve Maintenance

FOR A GENERATION past, the oil industry has steadily improved the quality of its principal products. On the basis of performance, the cost of gasoline to the consumer, despite the greater expenditure for labor and all mechanical operations, is less than it was 25 or 30 years ago since two gallons of motor fuel today will do the work of three at the earlier period. Taking account only of the quoted price per gallon, without regard to the sharp decline in the purchasing power of the dollar, the motorist's outlay for fuel, before inclusion of constantly mounting state taxation, has risen less than almost any other commodity in general use.

This is a record of which the oil industry may be genuinely proud and for which the users of its products should be equally grateful in view of the larger part that petroleum plays year by year in the operations of industry and in daily life.

Invention and research directed to the improvement of quality and the cheapening of processes on which the petroleum industry spends hundreds of millions annually may modify the cost trend, but it cannot wholly offset the influence of factors over which ingenuity and science exercise no control.

In the comprehensive analysis of the cost of finding oil by H. J. Struth, which appears on other pages of this issue, some of these uncontrollable influences are set forth with convincing statistical detail. As Mr. Struth's study reveals, the cost of adding a barrel of oil to known reserves in 1953 was more than five times the corresponding expenditure in the thirties, while the number of wells drilled to maintain the growth in reserves was more than three times greater than in the period directly preceding the late World War.

Not only is it necessary to drill many more wells in order to maintain a safe margin of reserve supply, but the cost of drilling per foot is 3.7 times what it was in the prewar period. Aside from the heavier expenditure for labor and machinery, this rise is attributable to the greater depth to which the drill must go to find production. Drilling cost rises progressively as depth increases. Average depth of all wells drilled in 1953 was 4,725 feet against a depth of 3,300 feet prior to the war. As average drilling depth has been increasing for several years, the expectation is that the trend will continue with increasing upward pressure on costs.

As the finding of new sources of oil supply becomes more difficult, the search becomes more intensive and the expenditure on this score grows heavier. The outlay for exploration last year reached the tremendous total of $2.3 billion, or more than 42 percent of the value of all the crude oil produced. Appropriations made for 1954 indicate that the capital investment in oil search during the current year will equal or possibly exceed the record of 1953.

In every other phase of oil industry operation costs have been constantly rising in recent years. Leases are more expensive. Construction charges are higher. Capital investment in refinery expansion per barrel of throughput has expanded greatly. While the industry has been successful in finding more oil than has been withdrawn for consumption, this has been accomplished at a constantly ascending financial cost.

The crucial point in this situation is that the oil industry is purveying oil which was discovered at a much lower cost than that at which it can be replaced. Such a condition, if continued, must inevitably result either in a slowdown in oil production or a substantial rise in the price of oil products.

The industry's success in coping with the situation thus far has been due to the provision established by Congress which permits oil companies to charge off 27½ percent of their intangible costs to depletion, this in recognition of the fact that oil is a wasting resource which must inevitably be exhausted in the course of time. From time to time, and at almost every session of Congress, proposals are advanced for reducing this depletion allowance, but thus far the legislators have recognized the necessity of its continuance. As the facts amply demonstrate, the depletion clause is vitally essential to the healthy operation of the oil industry. The national security is too important to be jeopardized by any fiscal juggling that would impair the maintenance of adequate reserves or imperil the ability to meet emergencies.

World crude production 4.1 percent higher in first half year

WORLD PRODUCTION of crude oil increased 4.1 percent in the first half of 1954 over the same period of a year ago. Daily average output was 13,479,900 barrels daily compared with 12,950,300 b/d in the first six months of 1953, according to estimates gathered by WORLD PETROLEUM. June production figures are largely projected on the basis of estimates by principal producers in the most prolific areas.

Western hemisphere crude production averaged about 9,073,100 b/d in the first half, an increase of only 1.4 percent over the same period last year. Eastern hemisphere output was 10 percent higher at 4,406,800 b/d.

The upward curve of world production has been less abrupt in the past three months than it was in the first quarter. Daily average output during the June quarter was at a new peak of 13,545,500 b/d. First quarter production averaged 13,414,400 b/d.

Second quarter production in Latin America was slightly lower. The entire increase in the Western hemisphere was in North America. The United States and Mexico were contributors. Canadian output was cut back severely when the largest refining company in the Dominion shut down its plants for annual inspection and maintenance. March crude production in Canada dropped 57,000 b/d and there was an even further fall in output during April.

The Canadian refinery turn-around now is over and Alberta purchase nominations in June were back to the February level of about 272,000 b/d. Average production in Canada for the second quarter was about 227,000 b/d compared with 248,500 b/d in the first three months. Recent reports from Mexico show a sharp increase in production. Pemex is particularly active in its efforts to develop foreign markets for Mexican oil. The Angostura field recently has begun commercial production with oil being delivered by both pipe line and railroad tank car.

Output of Venezuela fields has been lower during the past three months due to a seasonal drop in fuel oil deliveries. Output averaged 1,848,000 b/d in the June quarter compared with 1,896,400 b/d in the March quarter. Other South American countries showed only minor fluctuations. Venezuela produces 85 percent of the oil output of South America so that any marked change in export demand for Venezuela crude is reflected in a correspondingly sharp modification of the continental figures. Venezuela currently is producing 13.9 percent of the world's crude supply.

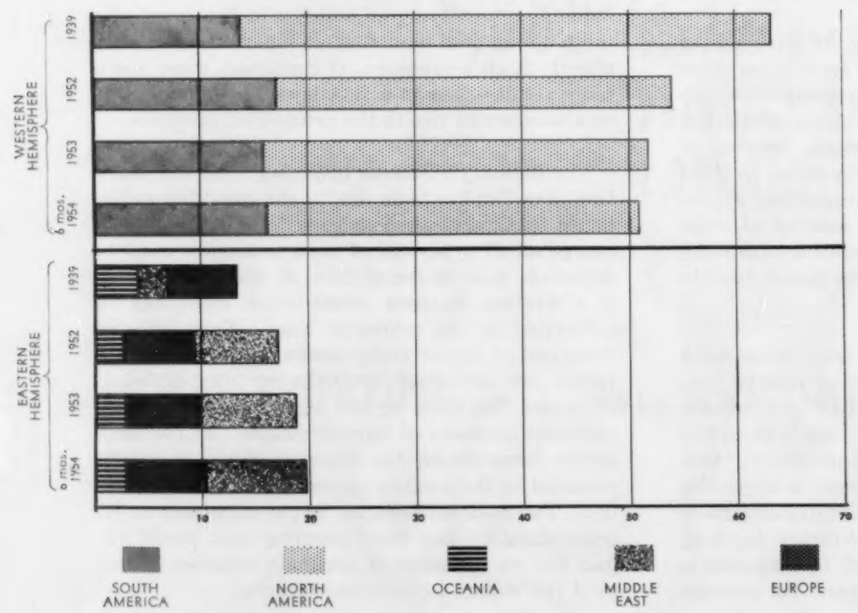
In the Eastern hemisphere, most important changes in the level of crude production have been in the Middle East and in Russia and Soviet bloc countries. Free Europe and the Far East have reported only minor changes in output. Eastern hemisphere fields now are producing about 33 percent of the world's oil supply compared with 31.4 percent in 1953. Western hemisphere fields are supplying two thirds of the oil compared with 68.6 percent in 1953.

The rise in Eastern hemisphere output has been generally in accordance with changes in demand. In the United States, which consumes about 56 percent of the world's petroleum products, it is anticipated that domestic demand this year will be about 3.3 percent higher than in 1953, according to most recent estimates of the United States Bureau of Mines. Major marketers in other parts of the world believe that the rate of increase in demand outside the United States will be about seven percent.

A major factor in Eastern hemisphere production is the continued rise in the output of Soviet block crude supplies. Estimates are that the U.S.S.R. will produce an average of about 1,150,000 barrels of crude per day in 1954 compared with 1,040,000 b/d in 1953 as announced by Soviet authorities. In general, it is believed by outside observers that the Russian production reports reflect output with a good deal of accuracy.

In Romania the tendency of observers is to discount government reports of very large increases in output. Belief is that natural gasoline and the fuel value of natural gas may be included with crude figures. Last year Romania reported a daily

PERCENTAGE DISTRIBUTION OF PRODUCTION



output of 186,000 b/d. This publication is using a current output figure of 120,000 b/d compared with 105,000 b/d in 1953. The active selling program of Soviet countries to foreign buyers tends to give credence to a substantial growth in output in both Romania and Russia.

In Free Europe the most notable changes in production recently have been in France and Western Germany. The new Parentis field in France is now in commercial production at the rate of about 1,100 b/d, bringing French output in Europe to about 8,200 b/d.

West Germany drilling operations continue active and output is rising steadily. Production reached 50,000 b/d in April and second quarter average was about 51,000 b/d compared with 42,200 b/d in 1953. As an example of recent activity, it is noted that drilling totaled 205,135 feet in March, a new national record. There were 29 successful completions during the month. Despite its success in developing oil, Germany still is importing about 108,000 barrels of oil daily.

West German production in 1953 totaled 15 million barrels. Wildcatting found more than twice as much new oil, according to recent estimates. Proven reserves in West Germany on January 1 were placed at 280 million barrels compared with 245 million barrels a year earlier. Probable reserves in addition to those proven have been estimated at an additional 100 million barrels.

The highest increase of proven reserves was found in the area between the Weser and Ems rivers and the upper Rhine valley. The discovery of seven new oil fields jumped reserves from 23 to 46 million barrels. The upper Rhine fields of Stockstadt and Rot now have a 7.8 million barrel reserve.

As the year 1953 had brought no new discoveries either in Emsland or in Holstein, current production in these two oil provinces resulted in a decrease of proven reserves. In Hanover the two discoveries of Kronsberg and Vorhop increased reserves 7 million barrels.

In East Germany a determined exploration campaign has been in progress for the past two years without notable success. Minor production is being obtained at Fallenstein and in the Langensalza-Erfurt region. Two rigs are busy in this area drilling to 6,000-foot depths. Wildcats are drilling near Berlin and in Mecklenburg. A number of light rigs are engaged in stratigraphic tests.

In the Middle East, the Neutral Zone has appeared as a new commercial producer of crude for world markets in the past six months. There has been considerable variation in shipments due largely to political considerations. Current output is in the vicinity of 9,000 b/d.

Just north in Kuwait output rose above a million barrels daily in March. Since then there has been a reduction of about 100,000 b/d to 904,200 b/d in the June quarter. Kuwait production is always limited to shipping demand and tends to vary with the arrival of tankers.

Saudi Arabian output has been hovering just below a million barrels daily throughout the past six months. Peak month was May, when demand reached 990,000 b/d.

Completion of the new pipe line from Zubair to Fao paralleling the old line has permitted a substantial production in southern Iraq. Total Iraq output now is above 600,000 b/d. This compares with about 574,400 b/d in 1953 and 383,400 b/d in 1952. Qatar production also is rising steadily and now exceeds 100,000 b/d.

Exploratory activity is continuing in Western Australia, where Caltex interests found a producing horizon some months ago. The discovery well is being deepened and is not on production. Additional drilling equipment is being moved in for step-out wells. Discovery by Caltex has renewed interest in other parts of Australia. A considerable number of concessions have been granted and the next year will see a considerable amount of wildcatting.

Elsewhere in Oceania and the Far East there have been no notable changes in the level of production.

As a whole, production has been fairly well in line with demand throughout the world, although potentials in flush areas are far greater than consuming requirements. Result has been the creation of pressures in some areas, notably in Canada and the United States.

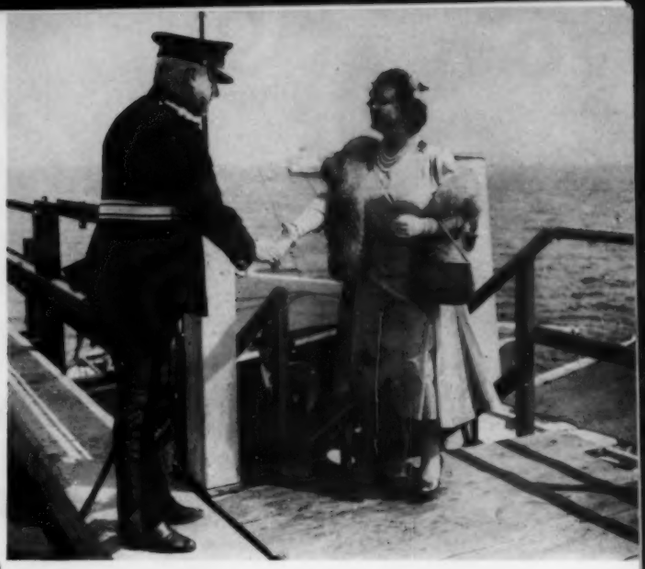
WORLD CRUDE OIL PRODUCTION

(Thousands of Barrels Daily)

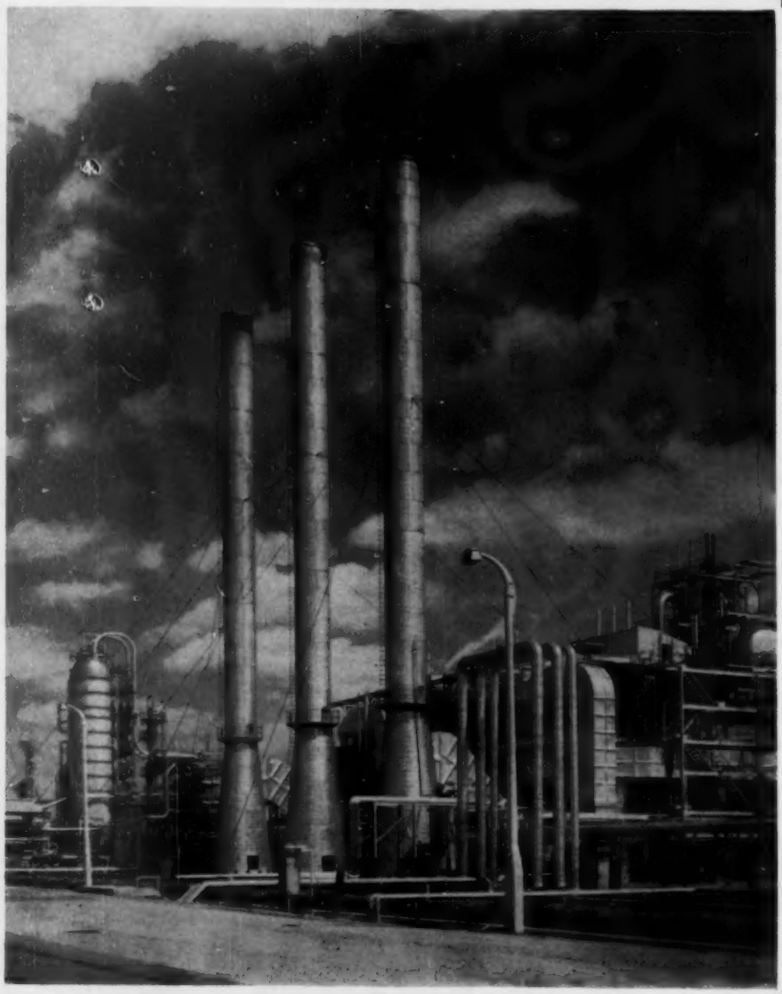
	1954 Second Quarter	1954 First Quarter	Year 1953
North America			
United States	6,460.0	6,375.2	6,466.6
Canada	226.9	248.5	220.9
Mexico	225.0	215.0	200.5
TOTAL	6,911.9	6,838.7	6,888.0
South America			
Venezuela	1,848.0	1,896.4	1,764.7
Colombia	115.0	114.6	107.8
Argentina	84.0	83.0	78.0
Trinidad	64.0	63.1	61.2
Peru	47.0	47.0	45.2
Equador	8.4	8.4	8.1
Bolivia	1.5	1.5	2.2
Cuba	0.1	0.1	0.1
Brazil	2.2	2.2	2.6
Chile	4.6	4.5	3.5
TOTAL	2,174.8	2,220.8	2,073.4
WESTERN HEMISPHERE	**9,086.7**	**9,059.5**	**8,961.4**
Europe & Africa			
Austria	62.0	60.0	60.0
Germany	51.0	48.0	42.2
Netherlands	17.0	17.1	15.6
Hungary	14.0	14.0	14.0
France	8.2	7.1	7.1
Yugoslavia	3.0	3.0	3.0
Algeria	1.7	1.7	2.0
French Morocco	2.1	2.1	2.1
Italy	2.0	2.0	1.8
United Kingdom	1.1	1.1	1.1
TOTAL EUROPE EXC. USSR & SAT.	162.1	156.1	148.9
USSR	1,130.0	1,095.0	1,040.0
Romania	120.0	110.0	105.0
Poland	4.0	4.0	4.0
Albania	3.0	3.0	3.0
Czechoslovakia	2.5	2.5	2.5
TOTAL USSR & SAT.	1,259.5	1,214.5	1,154.5
TOTAL EUROPE	1,421.6	1,370.6	1,303.4
Near & Middle East			
Saudi Arabia	964.9	951.3	845.0
Kuwait	904.2	891.8	862.2
Iraq	610.0	593.0	574.4
Qatar	101.0	96.8	84.8
Egypt	35.0	34.3	45.2
Bahrain	30.0	30.0	30.1
Iran	45.0	44.7	25.5
Neutral Zone	9.0	7.0	—
Turkey	0.6	0.6	0.5
TOTAL	2,699.7	2,649.5	2,467.7
Far East & Oceania			
Indonesia	205.0	205.0	209.1
British Borneo	102.0	101.0	101.0
Japan	5.9	5.9	5.8
India	7.0	7.0	6.5
New Guinea	8.1	6.0	4.9
Pakistan	4.4	4.4	4.4
Burma	3.0	3.0	2.5
China	2.5	2.5	2.0
TOTAL	337.9	334.8	336.1
EASTERN HEMISPHERE	**4,459.2**	**4,354.9**	**4,107.2**
WORLD TOTAL	**13,545.9**	**13,414.4**	**13,068.6**

PERCENTAGE DISTRIBUTION OF PRODUCTION

Principal Nations	1939	1952	1953	6 Mos. 1954
United States	60.0	51.0	49.5	47.7
Venezuela	9.8	14.6	13.5	13.9
USSR	10.5	7.4	8.1	8.3
Iran	3.7	—	—	—
Saudi Arabia	0.2	6.7	6.5	7.6
Kuwait	—	6.1	6.5	6.7
Iraq	1.5	3.0	4.4	4.5
Western Hemisphere	**76.7**	**71.0**	**68.6**	**67.3**
North America	63.2	54.0	52.6	51.1
South America	13.5	17.0	16.0	16.2
Eastern Hemisphere	**23.3**	**29.0**	**31.4**	**32.7**
Middle East	6.0	17.2	18.9	19.9
Oceania & Far East	4.1	2.4	2.5	2.5
Europe (including USSR)	13.2	9.4	10.0	10.3



On her arrival at the landing stage at Coryton refinery, Her Majesty the Queen Mother is greeted by the Lord Lieutenant of Essex, Sir Francis Whitmore.



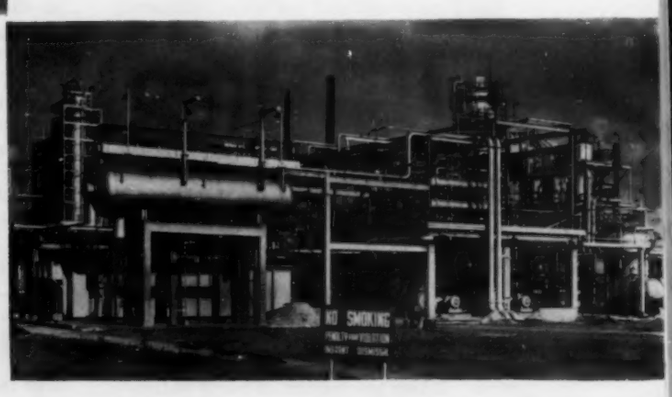
The three stacks of the power plant at Coryton, which produces 400,000 lbs. of steam per hour and can generate 10,000 kilowatts. At left is part of the crude distillation unit.

By E. Lawson Lomax

THE CONSTRUCTION PROGRAM of Britain's newest refinery at Coryton has now been virtually completed, with the exception of a minor portion of tank storage and the installation of a small amount of auxiliary equipment. The first units of the refinery went on stream at the end of January 1953, but owing to flooding during the heavy storms which swept the North Sea at that time, when the sea walls were breached, operations had to be suspended.

Through the major exertions of the staff and contractors, the site was sufficiently cleared within three weeks of the inundation to allow the plants to go on stream again. Since then the tale has been one of uninterrupted work toward completion of the whole of the plant, and every unit has now been completed and on stream.

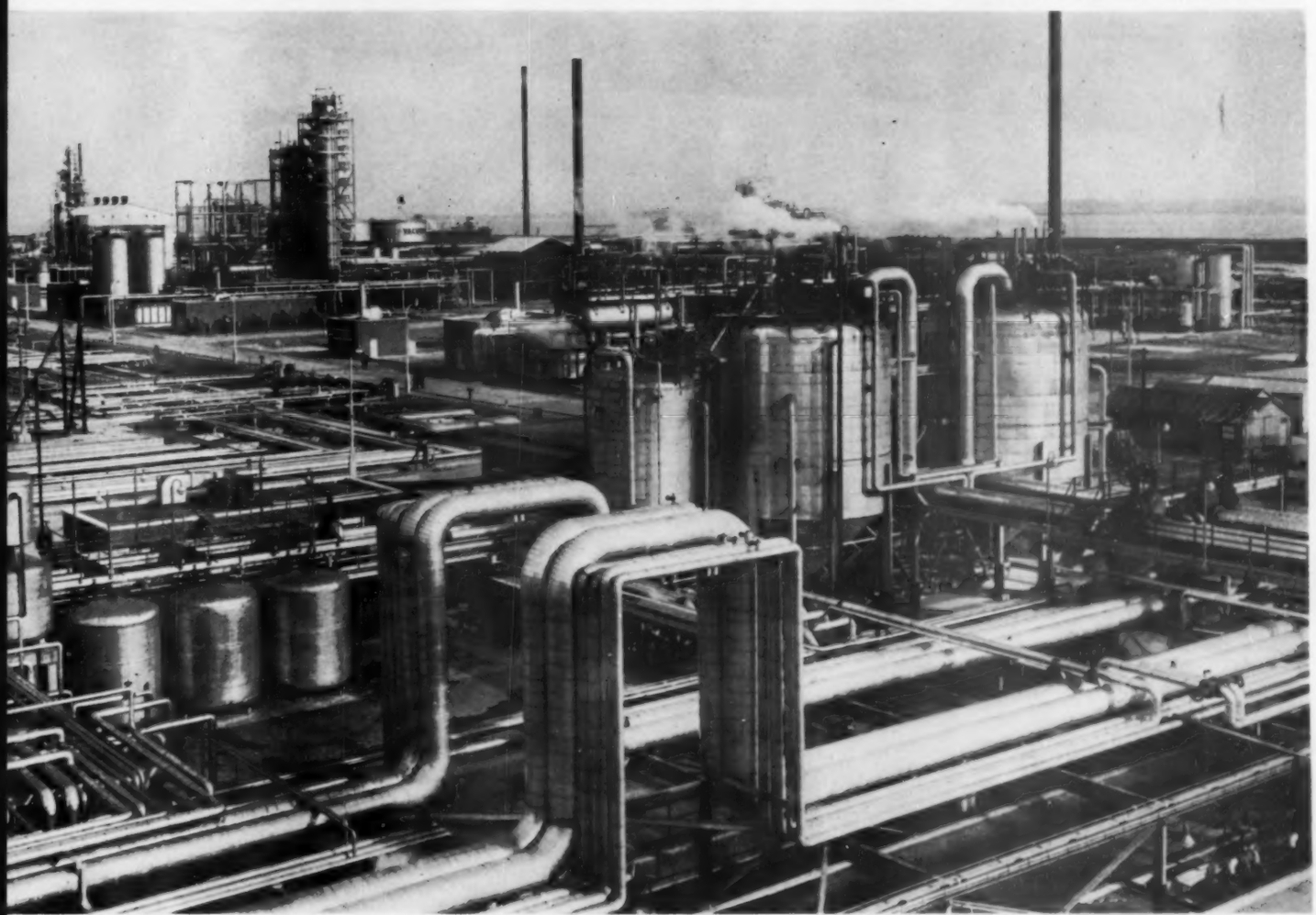
On May 27 the 17,000-barrel per day refinery was formally dedicated under the auspices of the Queen Mother, who graced the occasion by her presence and unveiled a tablet commemorating it. Other public officials and prominent business men who attended the ceremonies included United States Ambassador Winthrop W. Aldrich; Sir Herbert Merret, chairman of the board of Powell Duffryn; Viscount Waverley, chairman of London Port Authority; Sir Douglas Ritchie, vice chairman,



The propane de-asphalting unit at the refinery. Large tank at left is used for storage.

CORYTON refinery now in full operation

General view of the refinery, with the water treating plant in the foreground. The refinery uses over 1,000,000 gallons of water each day in its boilers and 45,000,000 gallons for cooling purposes.



Port Authority; Rt. Hon. Alan Lennox-Boyd, Minister of Transport; Hon. L. W. Joynson-Hicks of the Ministry of Fuel and Power; B. Brewster Jennings, president of Socony-Vacuum Oil Company; John G. Gridley, chairman of Vacuum Oil Company Ltd.; A. L. Nickerson, vice president of Socony-Vacuum; and Miles B. Reid, Socony director.

This latest addition to the refining facilities of the United Kingdom represents a combination of British and American capital and enterprise, being jointly owned by Powell Duffryn Ltd. and Socony-Vacuum Oil Company.

It is now feasible to discuss the process side of the plant as apart from the design and constructional features which have been previously described.*

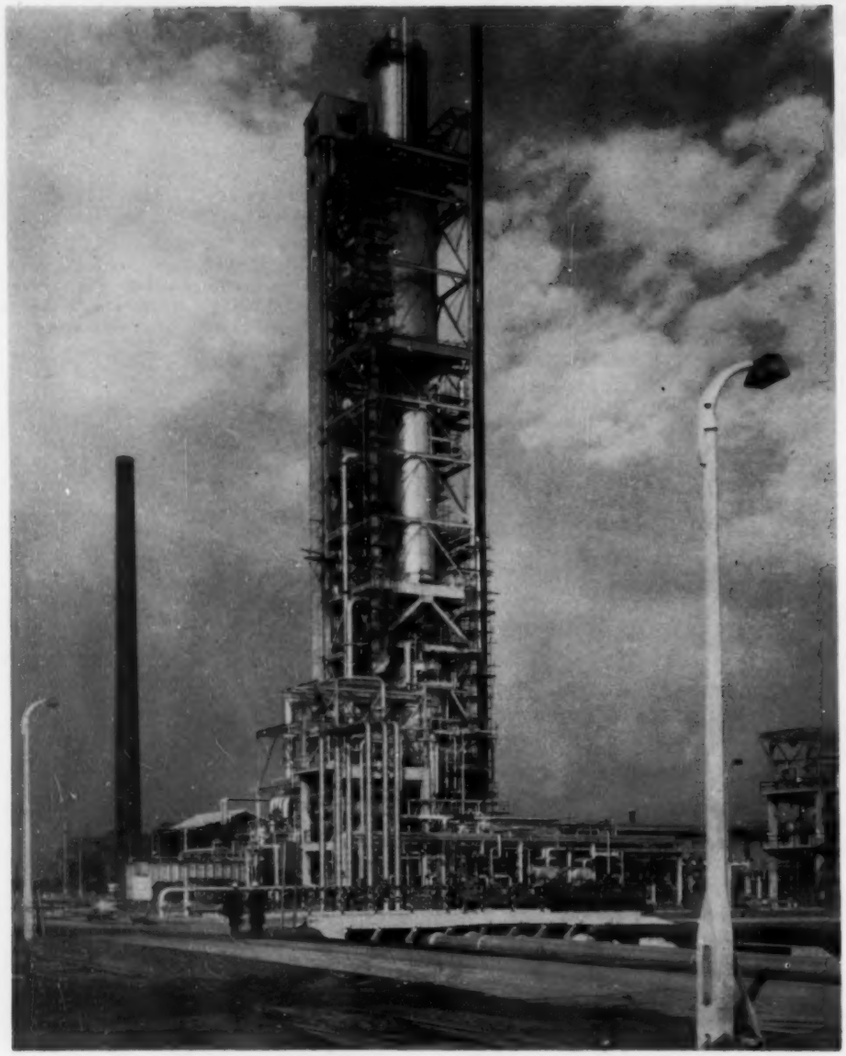
The refinery was designed mainly for the production of basic lubricants for blending into standard grades, with light and heavy fuels, in amounts varying with the type of crude feed stock.

In this design, four types of potential crude oils were taken into account, all from the Middle East, i.e. Iraq, Kuwait, Saudi Arabia and Iran, the latter if available, and the plant had to be flexible enough to handle one or more types.

At the present time crudes from Iraq and Kuwait are being processed.

The main distillation unit is a combination atmospheric/vacuum unit of Fos-

* See WORLD PETROLEUM, Refinery Review 1952 and September 1953.



This 272-foot high Thermofor catalytic cracking unit is the only one of its kind in the United Kingdom. It uses a bead catalyst for production of high quality motor fuel.

ter Wheeler design with a stream day capacity of 20,000 U.S. barrels.

The pipe stills for this unit are two sided, with a convection unit and radiant heat side furnaces, the feed being divided between the two, both for the atmospheric section and the vacuum section.

The atmospheric tower is 82 feet high, 12 feet in diameter, and is fitted with 34 bubble trays. From this unit, an overhead gas and light spirit is taken, which is stabilized in the unit's stabilization column, the spirit going to storage for chemical treatment and gas going to refinery fuel.

Three side streams take off naphtha, kerosine and light gas oil; tower bottoms go through the vacuum unit pipe still to the vacuum tower by Pulsometer hot oil pumps. The kerosine and light gas oil are blended for "Mobil Diesel" which meets normal specifications for U.K. diesel oils.

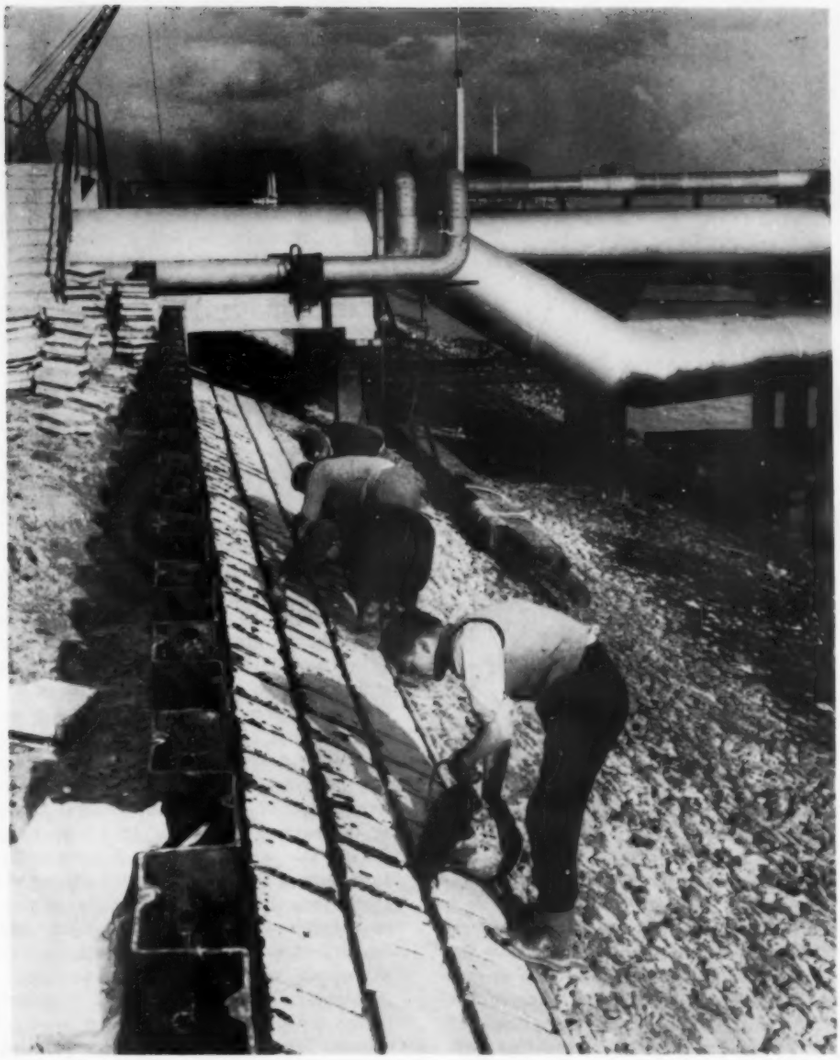
The naphtha goes to a thermal reforming unit which has a design capacity of 2,500 b/sd. The spirit from the reformer is stabilized in the unit and then passes to storage for chemical treatment; gas goes to the refinery for use as fuel and the small amount of heavy residue is blended into liquid fuel.

The vacuum tower is 100 feet high, 19 feet in diameter and is fitted with 28 bubble trays. This column gives four side streams: heavy gas oil, spindle oil, light neutral and heavy neutral stocks with a heavy asphaltic residue. The heavy gas oil goes as the main feed stock for the Thermofor catalytic cracking plant. The other side streams are passed on for solvent refining and de-waxing for the manufacture of basic grades of lubricants as blending stock for the production of the well known "Gargoyle" and "Mobiloil" international brands of lubricating oils.

The heavy asphaltic residue is propane de-asphalted prior to solvent refining and de-waxing for the production of bright stock for blending.

The Thermofor catalytic cracking plant has a capacity of 10,000 b/sd, handling a mixture of heavy gas oil, furfural extract and slack wax from the MEK de-waxing plant. The catalyst is used in bead form from one-eighth inch to one-quarter inch diameter and is a mixture of aluminum and silicon oxides with the addition of a chromium salt. The plant itself towers to a height of nearly 300 feet and is a conspicuous landmark both in the refinery and in the countryside surrounding the plant.

The TCC cracking process was developed by Socony-Vacuum as the result of intensive research and this is the first plant of its type to be built in the United Kingdom. The process, while having many special features of its own, follows a general catalytic cracking process in that the feed stock is contacted with a heated moving bed catalyst in a reactor section, where the cracking takes place, with the formation of gases and a fluid cracked stock.



Putting finishing touches on the new reinforced sea walls, originally built by the Dutch in the early 17th Century. Over three miles of wall around the refinery has been raised two feet.

Carbon, which is an inevitable product in a cracking process, is deposited on the catalyst and is later burned off in the regenerator section. The burning off in the regenerator section is temperature controlled in order to avoid overheating of the catalyst, with consequent reduction in its efficiency. The cooling coils used for this control are fed with treated water and generate steam at 600 psig which is used to supplement the normal supply from the boiler house.

The regenerated catalyst is passed by airlift to the catalyst feed tank or to the catalyst storage tank according to conditions. This air lift, in which the catalyst is raised over 200 feet, is one of the key points of the process, as it avoids the use of elevators, in which maintenance cost is a high factor. The liquid and gaseous products from the reactor pass to the synthetic crude tower and thence to the stabilizer and gas absorber which are of Socony-Vacuum design and integral with the plant. The dry gas is separated and goes into the refinery fuel system, the spirit going to storage for further treatment; the re-cycle stock goes back into the catalytic cracker cycle and a small amount of residue goes to liquid fuel.

The three grades of crude gasoline are all treated separately in the gasoline treating department. Following treatment they are blended into two grades of motor fuel, after which they receive their dosage of tetra-ethyl lead to bring the octane number up to market requirements. All three grades are first treated with caustic soda separately, after which they are solutizer treated, the solutizer solution being a mixture of caustic potash and mixed cresols. They are then separately inhibited, blended to two main grades, and finally leaded to requirements.

The various basic fractions of lube oil distillates and residue from the vacuum tower are in treated block operation, sufficient intermediate storage being available for the accumulation of each grade prior to taking its turn in block treatment.

Before furfural extraction the asphaltic heavy residue from the vacuum tower is propane de-asphalted in a Lummus de-asphalting unit, in which the heavy residue is treated under pressure with liquid propane. Asphalt is removed at the bottom of the treating tower and then passes via a heater to the de-propanizing system, from which propane is recovered for further use in the process and the separated asphalt passes through steam jacketed lines for use as boiler fuel. After de-propanization, the clarified heavy oil passes to intermediate storage before solvent treatment. This oil is used in the manufacture of bright stock.

The first step in the treatment is furfural solvent extraction, which is controlled to give products from each grade of whatever viscosity index is desired. The charge of oil to the furfural unit

(Continued on page 58)

The Thermofor Continuous Percolation Process

A FEATURE OF Vacuum Oil Company's refining facilities at Coryton, England is the installation of a continuous percolation unit as a finishing process for lubricating oil base stocks and waxes.

This Thermofor continuous percolation process is an application of the moving bed principle to the older static percolation process and was developed by Socony-Vacuum to provide the refiner with a modern economical method for finishing lubricating oils and waxes. The continuous percolation plant built at Coryton is the first commercial plant of this type to be constructed.

For some years the refiner's choice of a finishing process for decolorized lubricating oils and waxes has rested on one of two methods: either the percolation of oils through fixed beds of granular adsorbents such as Fuller's earth or bauxite, or hot contacting the oils with powdered activated clays. Virtually all of the new decolorizing plants installed in recent years have been of the hot contact type because of the low capital investment involved. This preference for the hot contact process has continued even though the adsorbent is used but once in this process, while the adsorbent used in the percolation processes may be regenerated.

In 1939 Socony-Vacuum introduced an improved method for regenerating percolation clays, namely, the Thermofor kiln. This was developed mainly to displace multiple hearth kilns or rotary burners, which were then used throughout the petroleum industry. Poor heat control and heat transfer characteristics in the latter units led to rapid degradation of percolation clays due to overheating during regeneration. Because of the rapid loss in efficiency, it was common practice to discard percolation clays after relatively few burnings. The resultant economic loss was considerable. The use of the Thermofor kiln maintained clay efficiency at a high level by virtue of better temperature control, with the result that the life of clays was more than doubled. In addition, investment operating and maintenance costs were lower than in the older type of burner. However, despite the attendant reduction in operating and investment cost, the overall economy of the percolation process was not sufficiently improved to overcome the low investment cost of the hot-contact process.

Socony-Vacuum pursued development work on other elements of the percolation process. The technique of countercurrent flow of granular solids and fluids was explored and applied to the percolation and clay washing steps of the finishing process. These steps, together with a simple continuous clay dryer and the previously developed Thermofor clay-burning kiln, were integrated into the Thermofor continuous percolation process. This process has distinct economic advantages over both the conventional static-bed percolation and hot-contacting processes for finishing oils.

The TCP unit includes a percolation section, a naphtha wash section and a regeneration section. The percolation section is equipped with a decolorizing tower and its auxiliary equipment for feeding and withdrawing oil and adsorbent. The naphtha wash section includes a wash tower with its auxiliary equipment and an adsorbent dryer. The regeneration section consists of a conventional Thermofor kiln and the elevators and conveyors for transporting adsorbent.

The oil to be decolorized is preheated to attain a viscosity consistent with good oil-adsorbent contact. It is introduced into the bottom of the percolator through a plenum chamber formed by the bottom head of the tower and a horizontal plate containing a number of inlet nozzles. The oil flows upward, counter-current to a moving bed of granular adsorbent, and is removed from the top of the tower, passes through a blotter press to remove traces of entrained clay, is cooled and sent to storage. Two clearly-defined phases exist in the percolator. There is a dense oil-adsorbent bed which occupies most of the tower volume and comprises the decolorizing section. Above this is a disengaging section consisting of an oil layer, at the surface of which the oil is withdrawn via a trough placed across the diameter of the vessel. The bed section of the vessel is baffled vertically to prevent horizontal travel of absorbent and consequent uneven withdrawal of adsorbent which may lead to oil channeling.

Regenerated clay from the kiln is fed to the top of the percolator via a surge hopper. The adsorbent rate is controlled by a metering and distributing device which supplies equal amounts of adsorbent to a number of feed legs entering the percolator. The clay feed legs are distributed uniformly over the cross section of the tower. Dry adsorbent from each feed leg is delivered to a soaking tube which extends from above the oil level in the percolator to a point just above the adsorbent bed. This soaking tube provides a quiescent zone in which adsorbent particles are wetted by the oil, at the same time disengaging the air coming in with the dry adsorbent. The top of the percolator is swept with inert gas and vented.

Spent adsorbent is withdrawn from the bottom of the percolator through a uniformly distributed, multiple pipe, draw-off system. The draw-off pipes originate in the oil distributor plant, pass through the oil plenum chamber and terminate in a collector pot with inlets so arranged that there is equal flow of adsorbent-oil slurry through each draw-off pipe. The volume of oil withdrawn from the percolator with the adsorbent is that required to fill the voids and pores of the

Prepared by the Technical Division of the Coryton Refinery.

adsorbent. A slurry flow control device maintains a constant total slurry withdrawal from the percolator consistent with the adsorbent feed rate to the percolator and the maintaining of a constant decolorizing bed height.

The problem of the measurement of adsorbent bed level has been overcome by utilizing the principle of the frictional resistance of a bed of granular solids to the flow of fluids. This creates a pressure drop across the clay bed, but a negligible one in the oil layer above. A change in bed height is reflected by a change in the differential pressure across the oil adsorbent interface.

The adsorbent flow to the percolator is maintained constant, this being dictated by the Thermofor kiln operation. Oil flow is varied according to the stock being processed and the degree of decolorizing required.

The spent clay and oil slurry discharged from the percolator enters the top of the wash tower, where it is washed countercurrently with naphtha in an operation similar to the percolation step.

The wash tower is fabricated in three sections of different diameter. The lower section is the smallest, and contains a compact adsorbent bed. The small diameter ensures a high velocity of wash naphtha to prevent oil settling with the clay under the influence of gravity. The section above is also part of the wash section, but is enlarged to prevent adsorbent carry-over by the more viscous oil naphtha solution. The normal bed level is maintained in this section. Bed height measurement utilizes the same principle as the percolator. The top portion of the wash tower is of even larger diameter, and comprises the oil-clay disengaging section. Here, velocity of oil naphtha solution is reduced still further to prevent carry-over of clay particles with the outgoing overhead stream. The naphtha clay slurry withdrawal is controlled to maintain a constant bed level in the wash tower.

The solvent naphtha used is of an intermediate boiling range and is highly paraffinic in nature to ensure that color bodies are not removed from the adsorbent surface during the washing process. The solvent naphtha is introduced into the bottom of the wash tower through distributing nozzles similar to the oil distributing nozzles in the percolator. Since there is a possibility of naphtha vaporizing when it contacts hot oil-adsorbent slurry in the top of the wash tower, a portion of the overhead stream from the wash tower is cooled and used to quench the oil-adsorbent slurry prior to its entry into the wash tower.

The naphtha oil solution taken overhead is charged to a stripper where naphtha and oil are separated. Stripped oil is recycled to the percolator with the fresh oil feed and naphtha is returned to the wash system.

The washed spent adsorbent and naphtha from the wash tower is discharged into a clay dryer. This step is necessary to effect complete removal of the naphtha before allowing the spent adsorbent to enter the regeneration system.

The dryer consists of a box-like vessel containing heating coils. A "boiling-bed" of adsorbent is attained by the introduction of superheated fluidizing steam at the bottom of the vessel. Naphtha is vaporized and the adsorbent dried by indirect heat exchange. The dry spent adsorbent is withdrawn over a weir to a seal leg which leads to the regeneration system. Naphtha-steam vapors are condensed and the naphtha separated and used as a wash solvent. An effective seal is maintained around the dryer so that there is no possibility of contact between naphtha vapors and air.

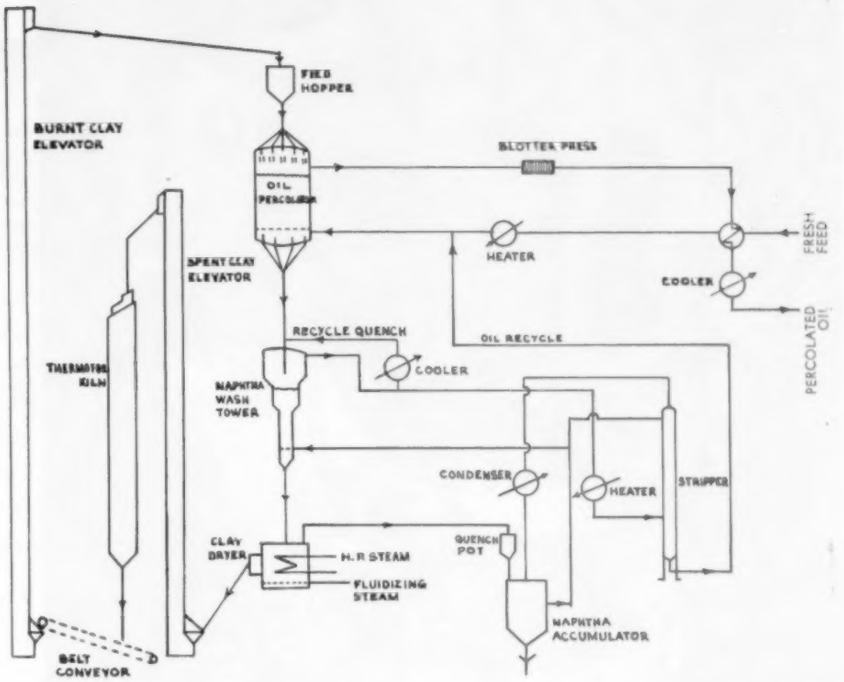
Dry spent adsorbent is transferred by bucket elevator to the top of the Thermofor kiln and is screened before entering the kiln hopper from whence it enters the kiln burning zone. Cooling coils in this section, through which molten heat transfer salt is circulated, perform the dual function of heating the incoming clay to combustion temperature and, when burning has been established, controlling this temperature to avoid overheating. Combustion air is introduced at the bottom of the burning zone and its rate and temperature are used to control the locality of the burning. Regenerated adsorbent is cooled before passing back to the percolator feed hopper via a conveyor and a second elevator.

The process has good flexibility for processing several stocks in "blocked" operation. By proper scheduling of stocks, it is possible to eliminate slop-oil cuts during change-over periods.

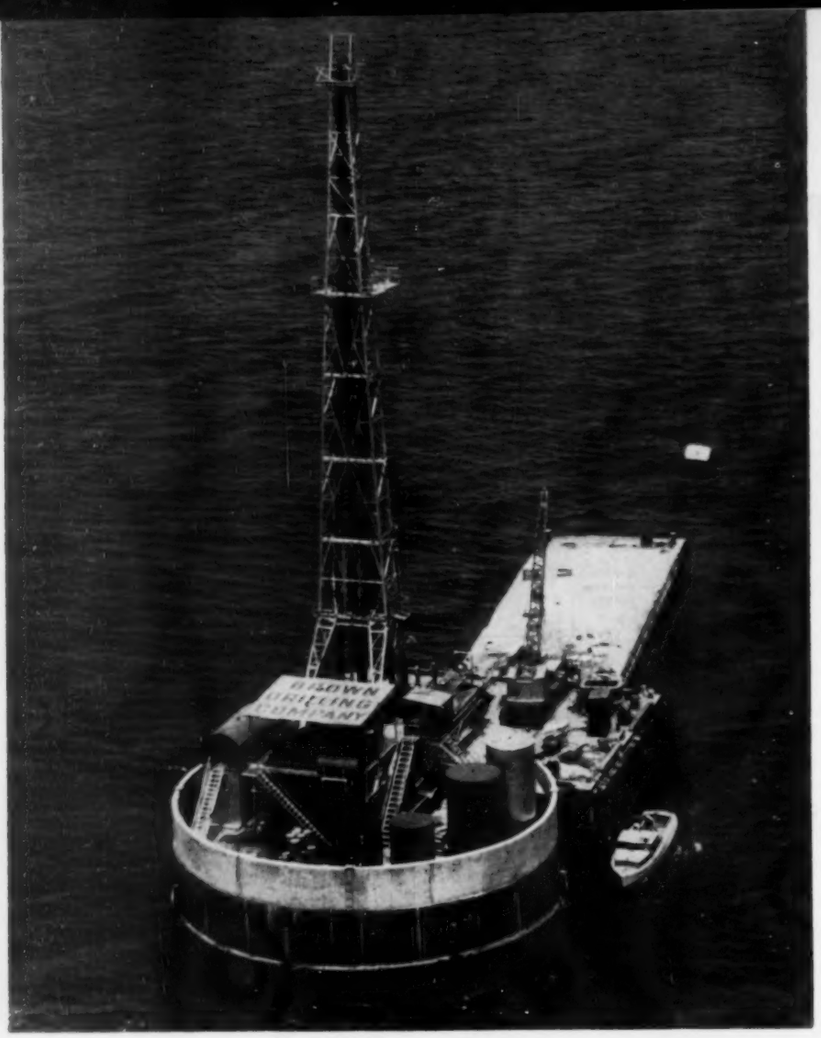
Percolation of waxes is carried out in a continuous process parallel to that of the oil treatment. The main difference lies in the fact that decolorizing of waxes is carried out in naphtha solution, which entails a different recovery set-up from that of the oil. This section has its own percolator and wash tower, necessitated by the risk of contamination by other stocks, but the drying and regeneration operations are common to both oil and wax sections.

An important feature of the process is to insure that water vapor is at no time allowed to condense, since this adversely affects the decolorizing characteristics of the absorbent after repeated regeneration.

This process is an attractive one to refiners from many points of view, as it possesses great flexibility and can be applied to a very wide range of lubricating oils and paraffins and microcrystalline waxes, giving yields much in excess of those obtained by conventional filtering for the same color improvement. The economics of the process are also attractive since considerable savings are made in adsorbent consumption and in loss of product.



Simplified flow diagram, oil section, of the Thermofor continuous percolation process.



Man-made island provides drilling site

UNUSUAL INTEREST is being displayed in Pacific Coast oil circles in an offshore well now being drilled. This is due not only to the fact that it is the first marine location to be drilled on the west coast since the recent legislation defining state and federal control in the so-called tidelands areas, but also because the drilling set-up embodies some exceptional features.

The well is a joint venture of Monterey Oil Co. and The Texas Co., with the former as operator. It is designated as Monterey-Texas State No. 3. The location is about 8,000 feet, approximately 1½ miles, from shore. It is directly west of Seal Beach on the California shore.

When bid calls were sent out in February by Monterey Oil Co., the specifications called for construction of a concrete island 75 feet in diameter, and adjoining it, a pile-driven superstructure 72½ by 56½ feet. With these provisions, the contractor was called upon to devise a drilling unit capable of going to 8,000 feet, workable on such a location.

Newell B. Hunnicutt, drilling superintendent, and Robert C. Walker, petroleum engineer, of the Brown Marine Drilling Co., contractor for the well, put together the knowledge gained from long experience and after extended consultation came up with the packaged rig they hoped would give them all the necessary operating equipment.

The drilling unit when built had the following specifications: Employed for power on the rig were four Murphy dual fuel engines, model 224-G. Three of these were put on the floor to be used for the table, drawworks and main pump power. The three engines transmit their power to a National compound drive through twin disc disconnecting hydraulic couplings. By employing this specific type of compound, specifications for which were set up by two Brown Company engineers, the whole engine power can be thrown to the drawworks, which gives a hoisting input horsepower of 645. For drilling, the unit will supply 205 horsepower to the table and 410 horsepower to the main pump, an Ideal C-250 which is driven by a tail driver belt assembly. The main mud pump and also the standby pump are both set down in the substructure. The drawworks is a National 50-A equipped with a sand line reel. The table is an Oil Well 27½-inch with power transmitted through a chain drive from the drawworks.

Built into the substructure are two mud tanks, one on either side of the well head, each with a capacity of 190 barrels. With the tanks built in the substructure, the pumps were placed in the rear of the structure on the same level as the tanks. As previously mentioned, the Ideal C-250 pump receives its power from the compound drive. This being directly above, the power is brought down to the V-belt assembly. On the standby pump another Murphy engine is employed to drive an Ideal 150-B pump. All the piping and mud control valves are built in alongside the standby pump.

In spite of the tanks being placed in this position, enough room is still available to place the two shakers above one tank. This tank is divided into two sections, one to be used for a shale pit and the other for a pill pit. The tanks employ conventional type mud guns. The mud tanks and lower substructure were made by Medearis Oil Well Supply Co. on the specifications set up by the contractor.

The unit will employ a 126-foot Lee C. Moore mast. With the complete unit assembled on location, it was found that less room had been used than was originally anticipated. The entire structure had measurements of 38½ feet long, 22¾ feet wide and a height of 15 feet 4 inches from the mat to the derrick floor. Overall length, including the pipe racks, is 68 feet. The Pacific Coast has not had any tideland drilling to date, and it was found that many problems would have to be met. One of them was that of handling a unit which had to be barged out to the location and placed upon the island by cranes. Other problems included such items as fire fighting equipment, fuel storage, emergency crew and service personnel quarters, mud storage and pipe storage.

By employing directional drilling equipment, it is hoped to drill several wells from this one island. To further check the design and manufacture, the rig was assembled in the yard of Lacey Trucking Co. at Long Beach. Then it was moved to a shallow well, which was drilled for the Monterey Oil Co. before being placed on the island location.

Military petroleum advisory board

AS TWO WORLD CONFLICTS have demonstrated, oil is a decisive factor in modern war and the myriad problems of oiling any armed struggle that may erupt are of necessity the subject of continuous study by those who are charged with the maintenance of national security. With the dissolution of the Petroleum Administration for Defense, which officially ended its career on May 1, a natural and logical step was the establishment of an advisory body which could act as liaison between the government and the oil industry, keeping the former advised of the extent of the nation's available resources and informing the latter of the requirements that would make it possible to meet any emergency that might arise.

This was the primary reason for the action of Secretary of the Interior McKay in establishing the Military Petroleum Advisory Board consisting of 21 prominent petroleum executives. The setting up of the board is in reality the reactivation of an earlier body which was discontinued after the outbreak of the Korean war when PAD came into existence.

The military petroleum advisers convened for the first time on May 25 to organize and elect officers. W. W. Keeler, vice president of Phillips Petroleum Co., was elected chairman. Elmer E. Batzell, counsel for the Independent Refiners Association, was named to draw up a code of procedures.

Chairmen of panels were elected as follows:

Oil production: A. C. Rubel, vice president, Union Oil Co.

Oil refining: C. E. Davis, vice president, Shell Oil Co.

Oil Transportation: Richard E. Nelson, Jr., Standard Oil Co. (Ind.).

Oil programs: Stewart P. Coleman, Standard Oil Co. (N.J.).

Oil materials: Elmer E. Batzell.

The board, which promises to be the chief point of contact between industry and government, is apart from and in addition to the National Petroleum Council, a committee of 100 oil and gas executives which advises the Secretary of the Interior. Unlike the NPC, which is continuing its functions, the military committee also advises the Secretary of Defense, can suggest parts of its own agenda and presumably will operate with more secrecy than the NPC. The official task of the military committee is to give "expert counsel, advice, and information on all oil and gas matters relating to national security and defense which may properly be laid before the board."

At the start, the military board was faced with a legal hurdle by Attorney General Herbert Brownell, Jr., who held that an industry committee may not have its own chairman or arrange its agenda.

Secretary of the Interior McKay, however, decided that "this Department may be justified in creating an advisory group which in its judgment poses no threat to the antitrust laws even though not all of the standards of conduct set forth by the Department of Justice have been followed."

Felix E. Wormser, Assistant Secretary of the Interior, and Thomas P. Pike, Assistant Secretary of Defense, welcomed the members of the board to the organization session.

Meanwhile, a status report on the United States petroleum industry, indicating a generally strong position from the defense standpoint, came from Secretary McKay.

Addressing the Industrial College of the Armed Forces, the Secretary said:

"Production of aviation gasoline, which had been running about 110,000 barrels a day at the outbreak of the Korean hostilities on June 25, 1950, has more than doubled, reaching an estimated 258,000 barrels a day late in 1953.

"This is adequate to meet present and prospective peacetime military and civilian requirements. We still need more alkylation facilities, however, to meet wartime requirements for high octane aviation gasoline.

"From January 1, 1950 to January 1, 1953, crude refining capacity increased by nearly one million barrels a day, from 6.7 million to more than 7.6 million. It is now more than eight million barrels. There have been corresponding increases in oil transportation facilities and crude oil production capacity.

"Drilling, which in 1950 hit a new peacetime record of 43,279 wells, reached an all-time high of over 49,000 wells last year.

"Fortunately, jet fuels can be produced by basic refining facilities common throughout the petroleum industry. We do not anticipate difficulty in meeting the rapidly growing requirements for such fuels, but the output of the tremendous quantities needed in time of war would require a sharp cutback in the production of other refinery products. The expansion goal for basic refining capacity remains open."

Front row, left to right: Paul G. Benedum, president, Hiawatha Oil and Gas Co., Pittsburgh; Minor S. Jameson, Jr.,* assistant to the president, Independent Petroleum Association of America; Richard E. Nelson, Jr.,* general manager, crude oil supply and products pipe lines, Standard Oil Co. (Ind.), Chicago; George A. Davidson,* vice president, Standard Oil Co. (Calif.), San Francisco; J. W. Foley,* vice president, The Texas Co., New York; J. Ed Warren,* vice president, National City Bank, New York; A. C. Rubel,* vice president, Union Oil Co., Los Angeles; Thomas P. Pike, Assistant Secretary for Defense for supply and logistics, Washington; Felix E. Wormser, Assistant Secretary of the Interior, in charge of mineral resources, Washington; Hugh A. Stewart, acting director of the Oil and Gas Division of the Interior Department, Washington; George A. Landry, Office of Defense Mobilization, Washington; W. M. Holaday,* Socony-Vacuum Oil Co., New York; W. W. Keeler,* vice president, Phillips Petroleum Co., Bartlesville, Okla.; C. E. Davis,* vice president, Shell Oil Co., New York; Charles E. Webber,* assistant manager, Sun Oil Co., Philadelphia; Elmer E. Batzell,* counsel, Independent Refiners Association, Washington; Charles E. Spahr,* vice president, Standard Oil Co., Cleveland; and George L. Mateer,* director of manufacturing and research, Cities Service Petroleum, Inc., New York. Back row, left to right: Charles E. Gately of the Oil and Gas Division, Interior Department, New York; Victor E. Cooley, deputy director, Office of Defense Mobilization; Stewart P. Coleman,* Standard Oil Co. (N.J.), New York; J. Terry Duce,* vice president, Arabian-American Oil Co., New York; C. Stribling Snodgrass,* oil and gas consultant, Washington; Lieut. Cmdr. Franklin B. Goodspeed, Navy; Lieut. Col. Edward W. Austin, Army; Capt. Harry B. Dodge, Navy; Col. J. H. Baughn, Air Force; (all four with the petroleum logistics division, Department of Defense, Washington); Maxine Elzeer, Oil and Gas Division, Interior Department, Washington; Carroll B. Fentress, deputy director, Oil and Gas Division, Interior Department, Washington; and A. P. Frame,** vice president, Cities Service Oil Co., New York; consultant to the board. Other members of the board include: Reid Brazell,* president, Leonard Refineries, Inc., Alma, Mich.; D. K. Ludwig,* president, National Bulk Carriers, Inc., New York; B. L. Majewski,* president, Great American Oil Co., Chicago; J. Howard Marshall,* Signal Oil and Gas Co., Fort Worth; and Bruce K. Brown,** president, Pan-Am Southern Corp., New Orleans, consultant to the board. (*Indicates member of the board. **Indicates consultant to the board.)*

Oil finding cost at new peak level

IN A SUCCESSION of annual increases, the cost of finding a barrel of new oil reserves in the United States reached a record high level in 1953 of $1.08. This compares with an average initial cost in 1952 of 98 cents per barrel, and a pre-war average of 20 cents.

The oil industry's expenditures for exploration in 1953 aggregated the huge sum of $2,328,584,000, which comprised 42.4 percent of the gross value, after royalty payments, of all the crude oil produced in the United States.

A study of expenditures incurred in the search for oil in new wildcat areas of the nation reveals that the initial unit cost of oil found in 1953, in strictly new fields, amounted to an average of about $1.65 per barrel. In the past six years, the average cost of finding a barrel of new oil reserves has involved initial expenditures of $1.36 for every barrel of oil found in new fields.

The success of the oil industry's exploratory efforts in 1953, as measured by the quantities of oil discovered in ratio to the year's production, is demonstrated by the fact that the industry found 1.55 barrels of new oil for every barrel of oil produced. As a result, the nation's underground inventory of petroleum liquids increased by 1,438 million barrels. Despite the constantly growing demand for oil, today's reserves amount to more than 34.5 billion barrels, or twice as much as the known supply available in pre-war 1938.

While the American oil industry has managed well to maintain adequate future supplies of oil through its incessant search for new sources of supply, the facts make it clear that the nation's favorable position in this respect is made possible only through heavy expenditures of risk capital. In fact, the chances of finding oil today are decidedly less favorable than they were in pre-war years, and the costs are more than five-fold greater. Furthermore, the facts show that returns per exploration dollar in new reserves found in the last three years comprised only 1.3 barrels, against a pre-war 1936-38 average of 8.9 barrels per exploration dollar.

Despite the constantly increasing cost of finding and developing new oil reserves, the petroleum industry has extended the search for new sources of supply over an ever-expanding area. Today, more than 231 million acres of prospective oil lands are under lease by oil companies, embracing 32 states in the nation. The oil industry's effort to find new reserves, as measured by the number of exploratory wells drilled, is indicated by the fact that the industry is now drilling 3.4 exploratory wells to every such well drilled in the pre-war period, 1936-40. Last year, a total of 21,573 exploratory holes were drilled, compared with an annual average of 6,400 during the years 1936-40.

Today, an exploratory well drilled in the search for oil involves a cost, including overhead, of $107,940, compared with an average cost per well in the pre-war years, 1936-40, of $43,468. Thus, it is evident that costs have increased 2.5 times over pre-war years, while the industry's effort to find and develop new sources of supply has been multiplied by 3.4 over pre-war years. In a previous article on exploration costs published in WORLD PETROLEUM,* the writer emphasized the fact that exploration expenditures in 1953 were eight times greater than those incurred in the pre-war period, 1936-40. Particular emphasis was placed upon the fact that increasing depth has been a predominating factor in the oil industry's constantly rising cost of exploration. Today, the average depth drilled in the search for reserves is 4,725 feet, against a pre-war average depth of 3,300 feet. Moreover, today's greater depths involve an average drilling cost per foot of $15.26 compared with a pre-war average cost per foot of $4.13. Drilling costs increase in direct ratio to depth, and the trend today is in the direction of constantly deeper drilling to uncover oil reserves hidden in nature's storehouse.

In the light of the facts presented here, it is difficult to understand why the oil industry is continually confronted with attacks on the justification for the

This is one of a series of articles on the cost of finding oil by H. J. Struth, who is associated with Palmer Publications, Inc. at Dallas, Texas as editor of the WORLD PETROLEUM STATISTICAL YEARBOOK, which will soon be made available to the industry.

* See issue of March 1954.

27½ percent depletion allowance. Long experience has definitely demonstrated the need for the depletion allowance at the present rate and in the light of today's costs and today's rate of discovery per dollar spent, there is ample evidence to support a higher, rather than a lower rate of depletion allowance. Those who tamper with a factor that is of such critical importance to the maintenance of an adequate future oil supply, particularly in the light of existing world political conditions, should awaken to the realization that their efforts are jeopardizing the security of the nation. Oil is ammunition, in the event of war, and any obstacle to prevent the continued unceasing search for oil reserves in the United States is a threat to the immediate and future security of the nation. Viewed from any angle, the oil industry's depletion allowance is the best and most economical insurance against failure to maintain an adequate oil supply for the security of the nation and the economic welfare of its citizens.

Analysis of oil finding costs in 1953 indicates that the expenditure for a barrel of reserves in new fields averaged about $1.63. This was the average cost of 27 percent of the oil discovered last year. Oil found by extensions of previously discovered fields, which comprised nearly 73 percent of the total, involved an average

(Continued on page 45)

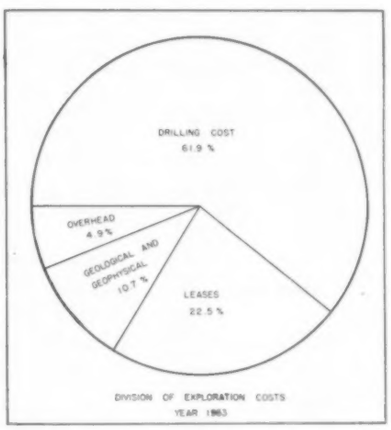


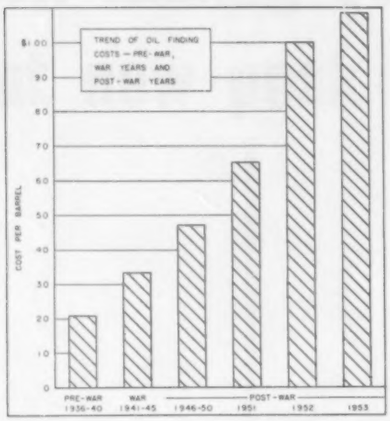
TABLE I

U. S. EXPLORATION EXPENDITURES AND COST OF FINDING OIL

	Pre-war Yrs. 1936-1940 Annual Avg.	1941-1945 Annual Avg.	Post-war Years 1946-1950 Annual Avg.	1951	1952	1953 (p)	Year 1953 (p) Percent of Total	Year 1953 (p) Cost Per Bbl. Res. Disc.
Drilling Cost (Thous. $)	82,351	201,366	604,663	1,018,565	1,217,365	1,442,150	61.9	$ .670
Cost of Leases (Thous. $)	131,619	214,698	340,204	447,020	464,500	522,994	22.5	.243
Geol. & Geophys. (Thous. $)	35,249	57,052	93,109	165,830	193,500	248,197	10.7	.116
Overhd., Gen. Ofc. (Thous. $)	28,978	48,669	74,166	108,160	111,880	115,243	4.9	.053
Total Cost (Thous. $)	278,197	521,785	1,112,142	1,739,575	1,987,245	2,328,584	100.0	1.082
Exploratory Wells Drld.	6,400	7,145	12,585	18,760	19,350	21,573		
Drilling Cost Per Well*	$12,867	$28,183	$48,046	$54,300	$62,900	$66,850	61.9	$ .670
Overhead & Other Cost Per Well	30,601	44,845	40,324	38,300	39,800	41,090	38.1	.412
Total Cost Per Well	43,468	1,815	2,195	3,102	2,372	2,516	100.0	*1.082
New Oil Res. Disc. (Mill. Bbl.) (A)								
New Fields	660	407	575	465	578	688	27.4	*1.630
Extensions	943	1,408	1,620	2,637	1,794	1,828	72.6	*.748
Total Res. Disc.	1,603	1,815	2,195	3,102	2,372	2,516	100.0	* 1.082
Net Working Int. (85.5%)	1,371	1,552	1,877	2,372	2,028	2,151		
Avg. Cost Per Bbl.	$.203	$.336	$.469	$.656	$.980	$1.082		

(p) Preliminary estimates.
(*) Includes equipment.
(A) As reported by Joint Committee on Reserves of the Amer. Pet. Institute and Amer. Gas Assn. Averages for pre-war years adjusted to include estimates of nat. gas liquids.

Oil Finding Cost at New Peak Level



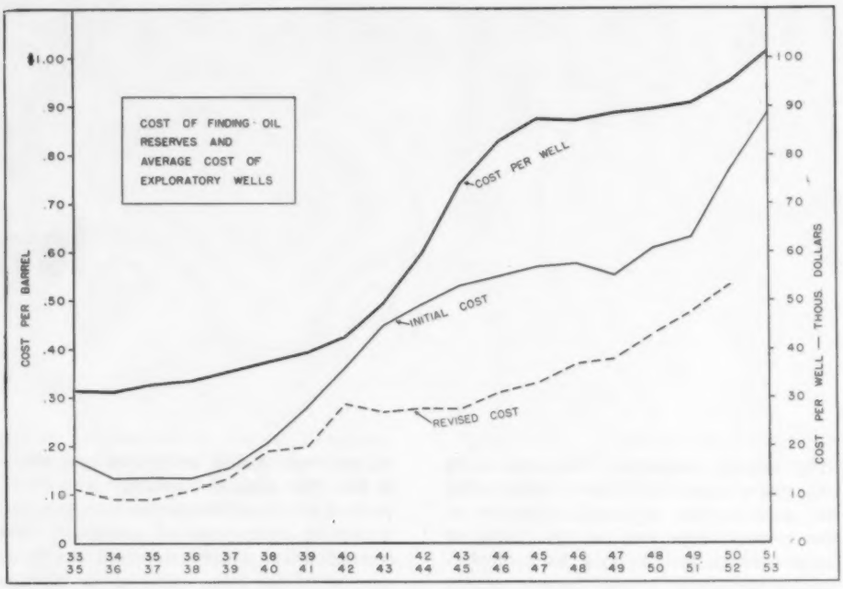

COST OF FINDING OIL RESERVES AND AVERAGE COST OF EXPLORATORY WELLS
COST PER WELL
INITIAL COST
REVISED COST
COST PER BARREL
COST PER WELL — THOUS. DOLLARS

TABLE II
COST OF FINDING OIL IN THE UNITED STATES
Incorporating new revisions in previous estimates and ultimate reflections of costs in prior years

Year	Initial Res. Disc. Gross (Mill. Bbl.) (1)	Initial Res. Disc. Net W. I. (Mill. Bbl.) (2)	Revised Res. Disc. Gross (Mill. Bbl.) (3)	Revised Res. Disc. Net W. I. (Mill. Bbl.) (4)	Expl. Wells Drilled (5)	Drilling Cost (Thous. $) (6)	Other Costs (Thous. $) (7)	Total Cost (Thous. $) (8)	Cost Per Bbl. Initial Disc. (9)	Cost Per Bbl. Revised Disc. (10)	Cost Per Well Drilling Cost (11)	Cost Per Well Total Cost (12)
1944	1,243	1,063	2,311	1,976	7,503	240,479	277,180	517,659	.487	.262	32,051	68,994
1945	1,581	1,352	2,835	2,424	8,187	365,557	365,650	731,207	.541	.301	44,650	89,313
1946	1,635	1,398	2,767	2,366	9,403	420,386	405,800	826,186	.591	.349	44,708	87,864
1947	1,892	1,618	3,223	2,756	10,401	481,982	422,350	904,332	.559	.328	46,340	86,947
1948	2,270	1,941	3,179	2,718	12,850	602,575	532,901	1,135,476	.585	.418	46,890	88,364
1949	2,798	2,392	3,743	3,200	14,025	696,622	558,745	1,255,367	.525	.392	49,670	89,505
1950	2,382	2,037	3,416	2,921	16,249	821,750	617,600	1,439,350	.706	.493	50,570	88,600
1951	3,101	2,651	3,660	3,129	18,760	1,018,565	721,010	1,739,575	.656	.556	54,300	92,600
1952	2,372	2,028	2,867	2,451	19,350	1,217,365	769,880	1,987,245	.980	.811	62,900	102,700
1953 (p)	2,516	2,151	——	——	21,573	1,442,150	886,434	2,328,584	1.082	——	66,850	107,940
THREE-YEAR MOVING AVERAGES												
1933-35	938	802	1,467	1,254	4,329	48,354	87,826	136,180	.169	.109	11,170	31,524
1934-36	1,396	1,193	2,107	1,801	5,028	56,223	101,113	157,336	.132	.087	11,182	31,290
1935-37	1,637	1,399	2,534	2,166	5,760	67,318	120,330	187,648	.134	.087	11,687	32,578
1936-38	1,848	1,580	2,779	2,376	6,161	75,277	132,623	207,900	.131	.106	12,218	33,744
1937-39	1,744	1,484	2,577	2,203	6,525	83,779	147,833	232,612	.157	.135	12,840	35,649
1938-40	1,441	1,225	2,108	1,819	6,607	88,836	157,153	245,989	.201	.189	13,446	37,232
1939-41	1,150	977	1,667	1,442	6,969	101,696	170,820	272,516	.279	.198	14,593	39,104
1940-42	926	792	1,354	1,441	6,750	111,350	173,520	284,870	.360	.281	16,496	42,203
1941-43	873	747	1,481	1,174	6,679	133,643	196,696	330,339	.442	.263	20,009	49,459
1942-44	961	822	1,791	1,531	6,717	174,083	228,890	402,973	.490	.278	25,917	59,993
1943-45	1,228	1,050	2,348	2,008	7,464	257,027	295,823	552,850	.527	.275	34,436	74,069
1944-46	1,486	1,271	2,638	2,255	8,364	342,140	349,543	691,683	.544	.307	40,906	82,698
1945-47	1,702	1,456	2,941	2,515	9,330	422,641	397,933	820,574	.564	.326	45,299	87,950
1946-48	1,932	1,652	3,056	2,613	10,884	501,647	453,683	955,330	.578	.366	46,090	87,774
1947-49	2,320	1,983	3,381	2,891	12,425	593,726	504,665	1,098,391	.554	.380	47,785	88,402
1948-50	2,483	2,123	3,446	2,946	14,374	706,982	569,748	1,276,730	.601	.433	49,185	88,822
1949-51	2,760	2,360	3,606	3,083	16,344	845,645	632,451	1,478,096	.626	.479	51,740	90,437
1950-52	2,618	2,238	3,647	3,118	18,120	1,019,227	702,833	1,722,060	.769	.552	56,249	95,036
1951-53	2,663	2,277	——	——	19,894	1,226,026	792,441	2,018,467	.886	——	61,350	101,080

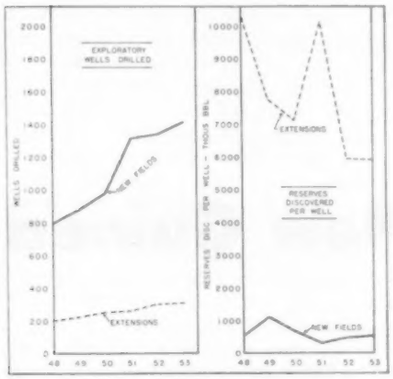
(2) and (4) net working interest = 85.5%.
(5) Wildcat wells and all dry holes drilled in exploration and development.
(6) Includes cost of equipping wells.
(7) Leases, geological, geophysical, & overhead.
(9) Col. (8) divided by col. (2).
(10) Col. (8) divided by col. (4).
(11) Col. (6) divided by col. (5).
(12) Col. (8) divided by col. (5).
(p) Preliminary estimates.

TABLE III
INITIAL COST OF FINDING OIL IN NEW FIELDS
United States

	1948	1949	1950	1951	1952	1953(p)	Avg. 6 Yrs.
Res. Disc. (Mill. Bbl.)	461	983	623	465	578	688	3,798
Working Int. (Mill. Bbl.)	394	840	533	398	494	588	3,247
Discovery Wells Drilled	783	880	980	1,320	1,340	1,415	6,718
Dry Holes Drilled	4,437	4,635	4,855	6,470	7,050	7,485	34,932
Total Wells	5,220	5,515	5,835	7,790	8,390	8,900	41,650
Drilling Cost (Thous. $)	443,700	479,805	504,700	539,350	680,215	755,066	3,402,836
Other Costs (Thous. $)	143,881	150,860	156,500	166,660	186,677	205,599	1,010,177
Total Cost (Thous. $)	587,581	630,665	661,200	706,010	866,892	960,665	4,413,013
Initial Cost (Per Bbl.)	$1.49	.75	1.24	1.77	1.75	1.63	1.36

(p) Preliminary estimates.

finding cost of nearly 75 cents per barrel. This is the cost of oil in place; it does not include the cost of developing and producing oil from the underground reservoirs. The condensed results of a preliminary survey of costs and the results of the oil industry's 1953 exploration program are shown in Table I. These facts provide preponderant evidence in support of the oil industry's 27½ percent depletion allowance and should be studied by those who say the depletion allowance is a "tax loophole." The nation's position with respect to underground reserves, shown in Table VII, makes it clear that the future availability of oil, in comparison with pre-war years, is a triumph for the oil industry and a sound argument for the retention of the present depletion allowance.



New reserves found in any one year represent only a part of the oil that may ultimately be found by extensions and development drilling. The experience of the industry over the past 22 years indicates that initial oil reserves discoveries are ultimately increased by a factor of 4.45 barrels to one barrel originally found. Studies indicate that it takes an average of at least eight years to fully develop a new oil field and to block out all of the oil available from a particular reservoir. During the period involved here, it is seen that initial estimates of oil found aggregated 11,880 million barrels. However, through extensions and revisions of initial estimates, the oil ultimately credited to the original discoveries aggregated 52,910 million barrels.

By allocating extensions and revisions back to the original discovery years, the effect is to increase the reserves above original estimates. For example, back credits since 1950 had the effect of increasing reserves in that year to 38,212 million barrels, whereas the original estimates indicated total reserves of 28,433 million barrels. Actually, the nation's oil reserves have shown a consistent increase practically every year since 1933, but ultimate credits to original discoveries have had a diminishing effect upon reserves since 1950. This does not imply that reserves are declining, but indicates that each year's discoveries are ultimately greater than originally estimated. Since 1950, for example, the increment in re-

(Continued on page 60)

TABLE IV
RESERVES DISCOVERED PER EXPLORATORY DOLLAR
(3-Year Moving Averages)

Period	Avg. Annual Expend. (Thous. $)	New Res. Disc. (Mill. Bbl.)	Reserves Per Dollar (Bbl.)
1933-35 ..	136,180	938	6.9
1934-36 ..	157,336	1,396	8.9
1935-37 ..	187,648	1,637	8.7
1936-38 ..	207,900	1,848	8.9
1937-39 ..	231,612	1,744	7.5
1938-40 ..	245,989	1,441	5.9
1939-41 ..	272,516	1,150	4.2
1940-42 ..	284,870	926	3.2
1941-43 ..	330,339	873	2.6
1942-44 ..	402,973	961	2.4
1943-45 ..	552,850	1,228	2.2
1944-46 ..	691,683	1,486	2.1
1945-47 ..	820,574	1,702	2.1
1946-48 ..	955,330	1,932	2.0
1947-49 ..	1,098,391	2,320	2.1
1948-50 ..	1,276,730	2,483	1.9
1949-51 ..	1,478,096	2,760	1.9
1950-52 ..	1,722,060	2,618	1.5
1951-53 ..	2,018,467	2,663	1.3

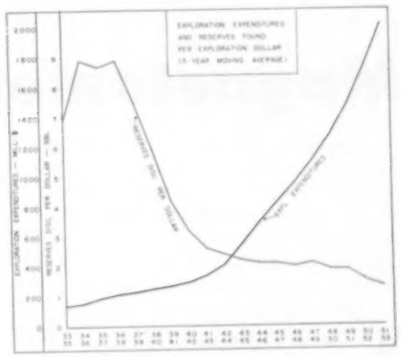

EXPLORATION EXPENDITURES AND RESERVES FOUND PER EXPLORATION DOLLAR (3-YEAR MOVING AVERAGE)
RESERVES DISC. PER DOLLAR
EXPL. EXPENDITURES

TABLE V
DRILLING AND EXPLORATORY RESULTS

	1948	1949	1950	1951	1952	1953(p)	Total 6 Yrs.
Wildcats							
Oil Wells New Fds.	783	880	980	1,320	1,340	1,415	6,718
Oil Wells Ext.	177	233	245	260	300	308	1,523
Gas Wells	245	203	233	260	265	347	1,553
Dry Holes	5,100	5,556	6,606	8,375	8,960	9,366	43,963
Total	6,305	6,872	8,064	10,215	10,865	11,436	53,757
Develop. Dry Holes	6,790	7,356	8,418	8,805	8,750	10,484	50,603
Total Expl. Wells	13,095	14,228	16,482	19,020	19,615	21,920	104,360
Dev. Oil Wells	21,068	20,697	22,806	21,485	21,950	24,277	132,283
Dev. Gas Wells	2,584	2,776	2,684	2,710	2,950	3,563	17,267
Total Drld. for O & G	36,747	37,701	41,972	43,215	44,515	49,760	253,910
Service Wells	2,159	1,184	1,215	1,230	1,405	2,450	9,643
Total all Wells	38,906	38,885	43,187	44,445	45,920	52,210	263,553
New Fields—New Pays							
Oil Wells Compl.	783	880	980	1,320	1,340	1,415	6,718
Res. Disc. (Mill. Bbl.)	461	983	623	465	578	688	3,798
Avg. Per Well (Thous. Bbl.)	588	1,117	636	352	431	486	565
Extensions							
Oil Wells Compl.	177	233	245	260	300	308	1,523
Res. Disc. (Mill. Bbl.)	1,809	1,815	1,759	2,637	1,794	1,828	11,642
Avg. Per Well (Thous. Bbl.)	10,229	7,790	7,180	10,142	5,980	5,935	7,644
Composite							
Oil Wells Compl.	960	1,113	1,225	1,580	1,640	1,723	8,241
Res. Disc. (Mill. Bbl.)	2,270	2,798	2,382	3,102	2,372	2,516	15,440
Avg. Per Well (Thous. Bbl.)	2,364	2,514	1,944	1,962	1,446	1,460	1,873
All Exploratory Wells							
Oil Wells Compl.*	12,850	14,025	16,249	18,760	19,350	21,573	102,807
Res. Disc. (Mill. Bbl.)	2,270	2,798	2,382	3,102	2,372	2,516	15,440
Avg. Per Well (Thous. Bbl.)	176	200	147	165	123	112	150

* Excluding gas wells.
(p) Preliminary estimates.

Refuelling at Merauke. Hand-pump was used to gas up between survey flights.

Papuans raft fuel out to moored Canso at Lake Murray. Spots at right of picture are due to tropical fungus which clung to camera lens.

Magnetometer survey in New Guinea

WHEN A CANADIAN CREW landed its Canso flying boat at Oshawa, Ontario, last summer after 113,000 miles of flying 'out New Guinea way,' no one around the municipal airport could escape two hours of coffee and captive listening. The crew were airborne magnetometer men who go aloft with a collection of electronic equipment and record the earth's magnetic variations on tape for the edification of geologists seeking untapped oil reserves. Magnetometer crews are precise fliers, skilled in maneuvering an aircraft to procure exactly the pattern of data wanted.

Flying experiences of the crew included basing their rugged Canso (a Canadian-built PBY) on a shallow tidal river a few hundred yards wide, dodging logs on take-off and landing, flying "crystal ball" between virtually unmapped jungle and an overcast that drops 300 inches of rain a year, servicing their aircraft and equipment in tropical darkness at the end of the world's supply lines, and, in their spare time, developing film (with the aid of ice cubes) at temperatures ranging up to 120°. The crew's smuggest boast was that cannibals in the area had failed to esteem them as a delicacy.

These minor hazards and inconveniences were incurred in carrying out two oil exploration surveys that covered not only 80,000 square miles of humid jungle, but also some international ramifications as twisted as a pretzel. One job, surveying 35,000 square miles of Papua, was assigned by the Australasian Petroleum Co. of Melbourne. The other, about 45,000 square miles of Netherlands New Guinea, was commissioned by a group of major oil companies with world-wide holdings. Both the jobs were contracted by Hunting Geophysics Ltd. of England. Hunting Geophysics in turn subcontracted the field operations to Aeromagnetic Surveys Ltd. of Toronto, whose surveys are flown by Kenting Aviation of Oshawa.

The choice, in such a curiously involved manner, of Canadian operators to carry out surveys on the opposite face of the globe is explained by two circumstances: the existence of a far-flung net of Hunting air-survey companies, and the advanced development of resources-inventory techniques in Canada. Over the past decade Hunting Aerosurveys Ltd. has established air-survey firms in Australia, New Zealand, South and East Africa, South America and Canada. None of these operations have languished financially, but the company set up in Canada in 1946, The Photographic Survey Corp. of Toronto, has become one of the world's leading air-survey organizations with a dozen subsidiaries, including Aeromagnetic Surveys and Kenting Aviation. Thus it was natural that Hunting Geophysics of England should call on its Canadian associates to execute tough assignments anywhere in the world.

The Canso crew's easy familiarity with everyday problems that beset magnetometer work under optimum conditions helped them to whip the handicaps provided by New Guinea. Despite a climate that has no pity on men or machines, the Canadians were grounded (water-logged might be a better word) only two days through unserviceability of aircraft or equipment. One day was lost when the Canso developed engine trouble, another when the magnetometer, which had been "tropicalized" to prevent fungus from invading its delicate components, went temporarily out of kilter. No other holdup except adverse weather was encountered between the time the Canso left Canada in December 1952, and the day it returned, seven months later, with 113,000 miles racked up on its log. Getting to and from the survey areas accounted for most of this mileage; actual line miles flown on the two surveys totalled 33,000. Likewise, most of the seven months' time was consumed in world commuting and in layovers, including a month at Sydney, Australia. The Papua operation took seven weeks, the New Guinea survey six weeks. However, with an average of 166 flying hours per month for four months, the Canadians figure their statistics should set some kind of record for magnetometer work, at least over head-hunting country.

In the Australian-administered territory of Papua the eight-man crew oper-

ated from Kikori, a remote police post located on a jungle river fifty miles from the coast and hundreds of miles from any other outpost of civilization. They found that Australasian Petroleum had moved in a comfortable houseboat (a converted Landing Craft, Tank) for their accommodation and a nondescript motorcraft known as a "bomb scow" to ferry personnel and gasoline to the moored airplane. About 20 Papuan workmen quartered in bamboo huts on the shore, an Australian foreman and an Anglo-Iranian representative, Danny Malone, a geologist thoroughly conversant with the special survey patterns required in New Guinea, completed the temporary community.

A typical work day (weather permitting, the crew worked seven days a week) began at 4:30 A.M. when the foreman touched a button at his bunkside to set off a nightmarish electric bell rigged up on shore. In theory, this awakened the Papuans only; in actual practice, everyone woke up screaming. At six o'clock the flying crew, consisting of pilot, copilot, flight engineer, navigator, and two magnetometer technicians, taxied out in the bomb scow and boarded the Canso. Pilots Bill Howes and Bob Pettus required only five minutes to warm up the engines at 100° F, turning neat figure eights in a treacherous channel while all hands scanned the water for floating logs. With only two choices for takeoff, upstream or downstream, Pilot Howes would check the river's flow (it reversed with the tide), decide which flight direction offered more chance of survival, and gun his big twin-engined boat into the air. This event began the best part of the day for everyone except the navigator.

On the ground, sodden heat and a perpetual plague of insects made life something less than desirable; aloft, even at the relatively low 1,000-foot cruising altitude required for magnetometer work, the Canso became an air-conditioned, insect-free living room. The homelike atmosphere was appreciated by everybody but navigator Carson (Kit) Fisher, a lean sandy-haired man who found himself too busy and too worried to enjoy it.

Fisher was responsible for keeping the pilot on the exact flight lines a magnetometer-equipped plane must follow, traversing back and forth across the earth's surface in a predetermined pattern as it records magnetic data. Accustomed to navigating by highly accurate maps or mosaics, Fisher made a dismaying discovery: all available maps of the area were both inaccurate and out-of-date. He could rely on them only along the coast, where features were easily recognizable. Inland, he turned himself into a sort of human compass *cum* hound dog *cum* water diviner, and navigated by inner ear. Over particularly featureless stretches of jungle which defied intuition, the pilot lifted the Canso to about 10,000 feet and the crew took navigation photographs with a large survey camera brought along especially for such emergencies. When recording magnetometer data at lower altitudes, a smaller 35-mm. camera provided aerial photographs adequate for "tieing-in" the magnetic profiles to known ground locations.

The routine of cruising back and forth over steamy jungle at constant altitude turned into tense drama one day when the crew heard an interchange of messages between a faltering, fully-loaded passenger plane and the efficient network of stations at Madang, Lae, Port Moresby and others that speed rescue in New Guinea. An airlines pilot reported he was lost in clouds over the massive Owen Stanley Mountains, with one engine gone and gas supply low. The Canso crew, out of range on the other side of the mountains, could only listen helplessly. Finally the pilot crash-landed, but the network's DF had fixed his position with pinpoint accuracy and held it right up to the crash. A rescue plane reached the scene within 45 minutes.

Another incident ended in tragi-comedy: a police official asked the surveyers to drop supplies at a remote village. As the plane circled the cluster of mud huts and dropped a small parcel to check wind and warn bystanders away, tribesmen crowed out to watch. The crew let go a heavy sack of supplies. One of the spectators below rushed forward with outstretched arms to catch it. He did—full force. Shuddering, the Canadians looked back to see the villagers dancing home again, bearing the sack and their crushed townsman. "I guess they had him for dinner," commented Howes.

When necessary, the Canso refueled at a secondary gas cache at Lake Murray, more than 300 miles inland. A launch made ten trips up a fast-flowing river to stock the cache with 2,700 gallons; the trip up took 10 days, the trip down two days. Now and then, when Kikori was closed in by bad weather, the crew stopped overnight at Murray. On one of these occasions three Papuan tribes joined forces to stage a mammoth war dance for the Canadians' entertainment. The warriors whooped it up till dawn; the fliers, informed that as many as 40 local residents had been jailed at one time for feasting on their neighbors, retired at midnight into an uneasy sleep, punctuated with dreams of being barbecued.

Normally the Canso returned to Kikori base about 4 P.M. Two aircraft engineers, Mike Mugford and Tom Worley, worked over the plane and refueled it as tropical night came down swiftly. Dinner, preceded by refreshment, was an informal affair at seven. Most nights, as a deluge of rain poured, the houseboat crew members worked with magnetometer technicians Harold Sandau and James Gray into the small hours, processing 35-mm. film, putting magnetometer data in order and making duplicates of all film and records. The latter was an unusual precaution, taken in case any of the survey material, shipped weekly via a complicated network of airlines to London, was lost. None of it was.

Throughout the tough seven-week grind at Kikori the Papuans were amiable, cooperative and skillful. One husky workman was particularly proud of his skill at steering dugout canoes (which, incidentally, have an open-end stern usually plugged by the broad back of a Papuan woman) and of his success in steering a jeep. Shortly after the survey started, he announced that he was now ready to try out the flying boat, a suggestion stubbornly resisted by Pilot Howes.

During the second survey, in Netherlands New Guinea, the Canso was land-based at Merauke on a gutted World War II bomber strip, formerly used by the Royal Australian Air Force. The survey procedure here was similar to the Papuan operation, with living conditions not quite as primitive. However, there were difficulties: assigned a house without electricity or water, the Canadians installed their own generator and wiring, and rigged up a tank, hose and hand-pump.

Every man in the crew regarded the one-month stopover in Sydney for aircraft overhaul and planning of the second survey as the highlight of their trip. Summer on Sydney's fabulous beaches struck a happy mean between New Guinea's 120° in the shade and the 60° below zero the crew had encountered on a previous survey over Canada's frozen Yukon.

Several incidents enlivened the long flight home, after completion of the New Guinea survey. During a stop-over at Karachi a colony of birds built nests on the Canso's spacious ailerons. The plane was forced down by a sandstorm at Basra, and over Crete was struck by a bolt of lightning which reversed all compass readings. But the Canso's 113,000-mile tour had a Hollywood ending. Kit Fisher's fiancee, Lillian Serplus of Toronto, flew to London by commercial airliner, and the couple were married at venerable Caxton Hall. They honeymooned briefly in Paris and Dublin, where Mrs. Fisher waved goodbye to her husband. As Fisher navigated the slow, dependable Canso across the Atlantic, Lillian took a fast airliner, and waved hello when her husband landed at Oshawa Airport.

Back at Oshawa, Photographic Survey Corporation's magnetometer men didn't have too long to sit around chewing the fat and consuming coffee. A few weeks after their return they were heading for Labrador and Newfoundland, where subarctic weather is a more deadly risk than a few good-natured cannibals. Hazards of sky, terrain and social custom don't stop magnetometer operators. They just go right ahead, searching out indications of buried wealth in every corner of the world for an oil-hungry civilization.

Turkey's petroleum law opens country to private exploration

FOR CONVENIENCE in the understanding of Turkey's liberalized petroleum law and the handling of applications for exploratory permits, the country has been divided into nine districts as shown on the accompanying map. Of these areas, III and IV are partly closed districts, the others being open to applications for exploration, requests for which have been filed by a number of leading international companies.

Regulations governing the form and content of such applications require the filing of a written request for a permit or certificate giving full information about the applicant, including the country of incorporation and office location in Turkey and giving the boundaries of the area in which it is proposed to operate, the petroleum district and the term for which the permit is requested.

Applications for refineries must state the province, district and municipality, and for pipe lines, the start and terminus and the route. For both types of projects, there shall be submitted a general description.

A number of documents are to be attached in duplicate to each application. They include a statement that the company is a juridical person, its by-laws and officers, the previous actions in furtherance of the petroleum law of Turkey, the company's financial status and a summary of its past year's activities, as well as a letter from a recognized bank as to its financial ability. A map on a 1-800,000 scale is to be included.

For a refinery, there must be set out the proposed capacity, quality and quantity of crude oil to be refined, products to be turned out, the processes to be used, the refinery units, tankage, pumping stations, loading and unloading stations, safety practices and details of power plant facilities.

An *"avant projet"* also is to be filed, including a technical report, summary of specifications, a production cost analysis, the estimated profit to be derived and a summary of the costs.

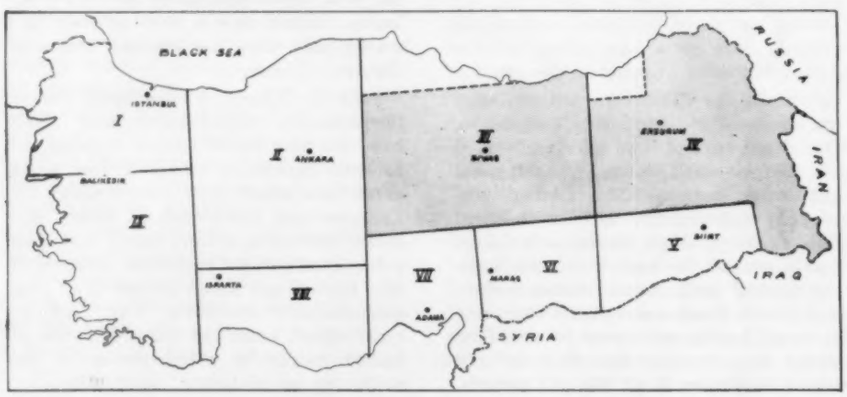
For a pipe line, a set of similar facts are asked, including a prospectus outlining the size, capacity and length of the line; the number, location and capacity of pumping stations; the tankage loading stations; safety practices; the processes to be applied and the pressure to be maintained in transporting petroleum; and plans of the route, with details for river, road, railroad and canal crossings.

For the pipe lines, also, an *"avant projet"* is to be filed, including a technical report, summary of specifications, production cost, estimated profits, analysis of the petroleum to be transported, and a summary of estimated costs.

The documents to be filed also include evidence of deposit with the accounting office of the required fee. The deposit of guarantees shall be in the following amounts: for an application involving one petroleum district, 50,000 Turkish pounds; two districts, 70,000; three, 90,000 and four or more, 100,000. In applications involving a refinery or pipe line, the sums are to be one percent of the estimated cost and payment of certificate filing fees.

An affidavit also is to be filed in duplicate listing the name of the company and certain financial details. The details include the amount of stocks and bonds held by each officer, and whether the stock is publicly quoted on any stock exchange, and what one; also, the amount of money budgeted for exploration in Turkey, the persons who directly or indirectly hold more than 25 percent of the stock or who would benefit from such or who hold voting power, as well as other financial information.

Map shows the nine petroleum districts of Turkey. Shaded areas indicate partly-closed districts.



Of the nine petroleum districts of the country, seven are open and two are mostly closed to petroleum exploration as shown by the map.

District one, in the northwest, open, includes Istanbul. District two, to the eastward, open, includes Ankara; district three, mostly closed, includes Sivas; district four, mostly closed, further east, includes Erzurum; district five, open, includes Siirt; district six, open, includes Maras; district seven, open, includes Adana; district eight, open, includes Isparta; and district nine, open, includes Balikesir.

Among the companies that have received exploration permits under the new Turkish law, directly or through subsidiaries, are: California Texas Oil Co., Royal Dutch/Shell, Socony-Vacuum Oil Co., Standard Oil Co. (N.J.), and Kern Oil Co. Companies that are reported to have expressed interest in possible applications are Cities Service, Gulf, Sinclair, and Richfield, among others.

In a statement commenting upon the Turkish petroleum law, Elmer E. Batzell, Washington consultant who was associated with Max W. Ball in drafting the new law, said, in a discussion before the Institute of Mining and Metallurgical Engineers:

"Turkey, in proportion to its resources, has perhaps spent more money in oil exploration than any other government. The work that it has done has been constructive, but it can reasonably be anticipated that several private companies in the course of several years will spend in the aggregate far more money than Turkey has spent in the 20 years she has been seeking oil. At the end of this period, despite persistent effort, Turkey still lacks a paying petroleum industry, so that 60 percent of her foreign exchange goes to petroleum products.

"Turkey has learned that a monopoly, either public or private, has but one determining judgment. It may be a composite judgment, but it is a single one. What that single judgment decides not to drill, is not drilled. A monopoly is likely to miss the significant oil fields that have been discovered by those who just didn't believe that one man's or one company's judgment was necessarily correct.

Of the geological situation in Turkey, Mr. Batzell said:

"A number of favorable looking structures have been mapped in southeastern Turkey and oil has been found in two of them. Geological work undertaken by the government suggests that numerous other structures can be found by intensive geological and geophysical surveys.

"The Adena-Iskenderun area shows con-

(Continued on page 76)

Big mobile compressors have many uses

View of inside of car showing one of the two 4-cylinder, 2-stage Clark air compressors, each driven by a 500 hp synchronous motor.

TO MEET NAVAL specifications, a mobile compressor plant has been constructed by Clark Bros. Co. of Olean, N. Y., the first of its kind to be built. This unprecedented unit, complete with 500 hp electric motors, switchboard, transformers and cooling and lubricating systems, aggregating 138,000 pounds, can be fitted into a single 60-foot box car.

The very day the first mobile unit was complete, two big stationary compressors at the Charleston naval shipyard broke down, jeopardizing construction and maintenance schedules. The mobile plant, which had been scheduled for a trial trip to the west coast, was diverted to South Carolina. It arrived there the following day and within 24 hours had been inspected by engineers and put into service.

The Navy reported that the mobile compressors worked a regular 8-hour shift for the next 42 days while the damaged stationary units were being repaired. The success of this first unit is expected to lead to extensive use of such plants by the armed forces and also by private industry.

The idea was born in 1951 when the Navy needed a large quantity of compressed air for a temporary project. Bureau engineers felt it was wasteful to construct a compressor building, put in concrete foundations and install stationary compressors. At the time, no alternative was available, but it was recognized that a mobile plant would be ideal in such a situation, providing air supply immediately and saving the taxpayer the cost of building and installation.

The Navy's experience indicated that other important services could be rendered by a high-volume, heavy-duty mobile compressor. The 5,000 cfm size and 125 psi pressure were specified because they are standard in shipyard service and lesser units would not meet the need. To get this high capacity into a single railway car, it was decided to have the compressors driven by electric motors. Navy engineers reasoned that any project that required so large a volume of compressed air would also need a lot of electric power and that provision should be made to supply the power. Otherwise the plant was to be wholly self-sufficient so that it could be hooked to a power supply line and an air outlet line and go right to work, just as it did at Charleston.

To meet the exacting requirements of the service demanded of mobile units, Clark used two identical LCMA-4, two-stage air compressors, each with a capacity of 2,500 cfm. Basically, this is the company's regular 4-cylinder, 8-inch stroke, balanced/opposed compressor, heavy-duty, compact, vibration-free unit. Normally, all four cylinders are horizontal, making the unit too long for the space available in the box car. The solution was a four-cylinder unit with the two 20-inch low-stage cylinders vertical and the two 11¾ inch high-stage cylinders horizontal. In spite of this rearrangement of cylinders, all parts are standard and internal balance has been maintained.

Each of the two compressors is driven by a specially compact 500-hp synchronous motor mounted on the end of the crankshaft. A motor bearing is built into the compressor and there is no need for a space-consuming outboard bearing. The required WR^2 is incorporated in the motor rotor, eliminating need for a flywheel. These medium-speed motors are easy to start across the line, limiting inrush to 300 percent. To facilitate starting, and also to regulate compressor output, all compressor cylinders are equipped with suction valve unloaders which provide automatic five-step unloading. Electric immersion heaters in both lubricating and cooling water systems make it unnecessary to start a compressor cold.

Each compressor is self-sufficient, complete with its motor, air, water and lube oil systems, all mounted on structural steel skids so that the entire unit can be pulled out of the car for major maintenance. In practice, this should only rarely be necessary, for ports are provided in side and top of the car to permit all normal maintenance, including pulling pistons without taking the compressor from the car.

Intercooler, aftercooler, oil cooler and water cooler all are built into a single compact unit with a bundle of finned tubes for each circuit. The air, water and oil in these tube bundles are cooled by air drawn through shutters in the end of the car by a pair of motor-driven centrifugal blowers and discharged upward through the cooling sections and out through hatches in the car roof. Automatic thermostatic controls, activated by the temperature of compressed air leaving the aftercooler, regulate the shutters. An ethylene glycol coolant is circulated through the compressor-cylinder jackets by a motor-driven centrifugal pump and is kept at the desired temperature by an automatic thermostatic control which bypasses coolant as necessary around the tube bundle. A similar thermostatic control keeps lubricating oil temperature at the current operating level. The compressors have the additional protection of automatic shutdown in the event of high coolant temperature, high crankshaft bearing temperature or low lube pressure.

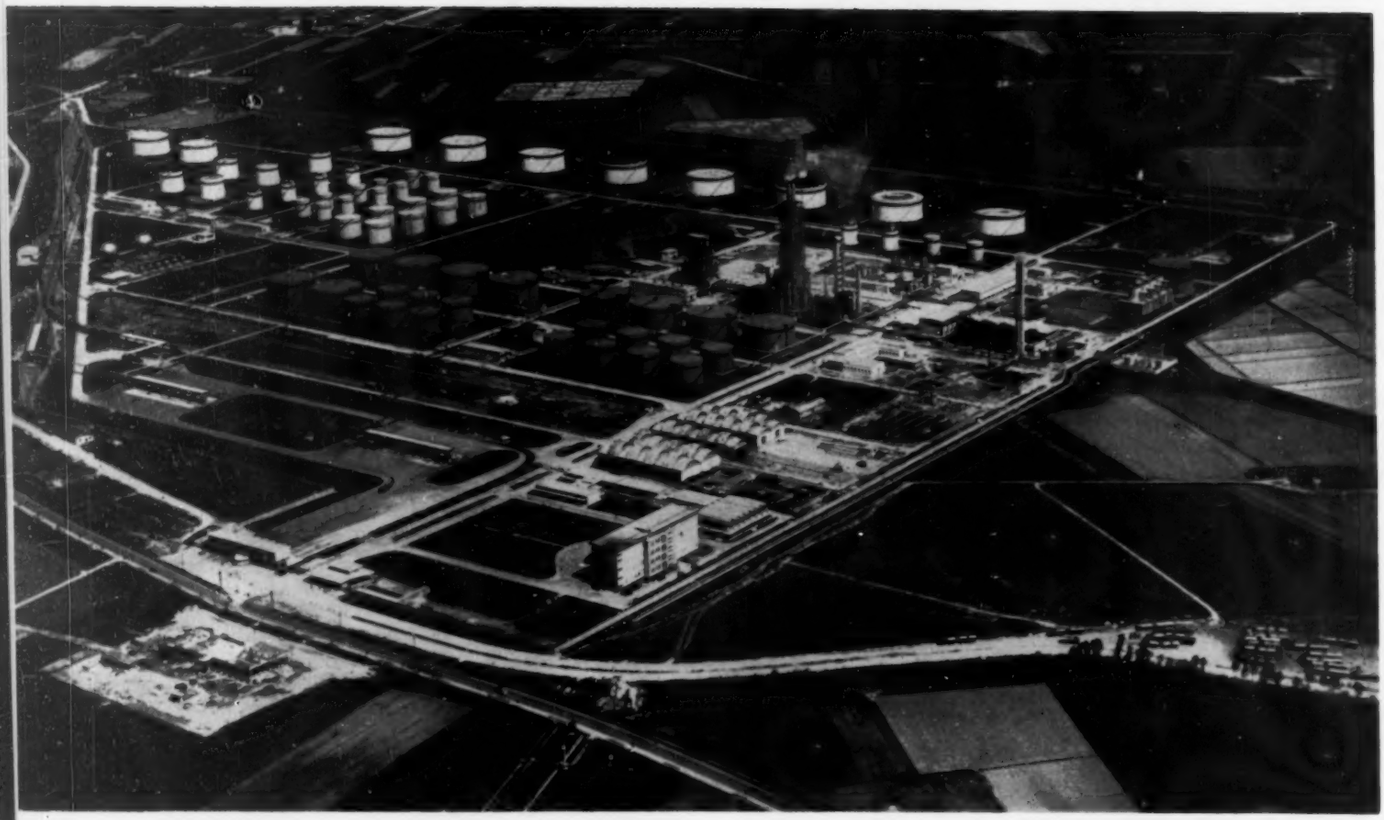
The design engineers did not permit space limitations to force any compromises on equipment. All air that enters the car is cleaned by impingement type filter panels. Air for each of the compressors is drawn through a four-panel filter into a suction intake box, then through an intake silencer to the suction of the low stage compressor cylinders. The air is discharged at 47 psia to the intercooler, then through a separator to remove moisture and impurities, and into the suction of the high stage cylinders. At a discharge pressure of 144 psia, the air goes to the aftercooler, then to another separator and finally to either of two huge air receivers slung under the car. Either or both compressors can send air to either or both receivers, and it is possible to hook the distribution line to either receiver from either side of the car.

The plant can be operated indefinitely with all doors closed, motor-driven fans providing ample ventilation.

Another factor that increases the flexibility of the mobile plant and permits it to get to work quickly is its ability to use a power supply at either 4,160 volts or 2,400 volts. The complete motor control center, 13 feet, 4 inches wide, 60 inches deep and 90 inches high, includes an incoming line panel with two load interrupter switches, either of which can be closed, depending on the supply voltage. If voltage is 4,160, the control panel employs a kva auto-transformer to

(Continued on page 80)

CONDOR refinery serves industrial area of Northern Italy



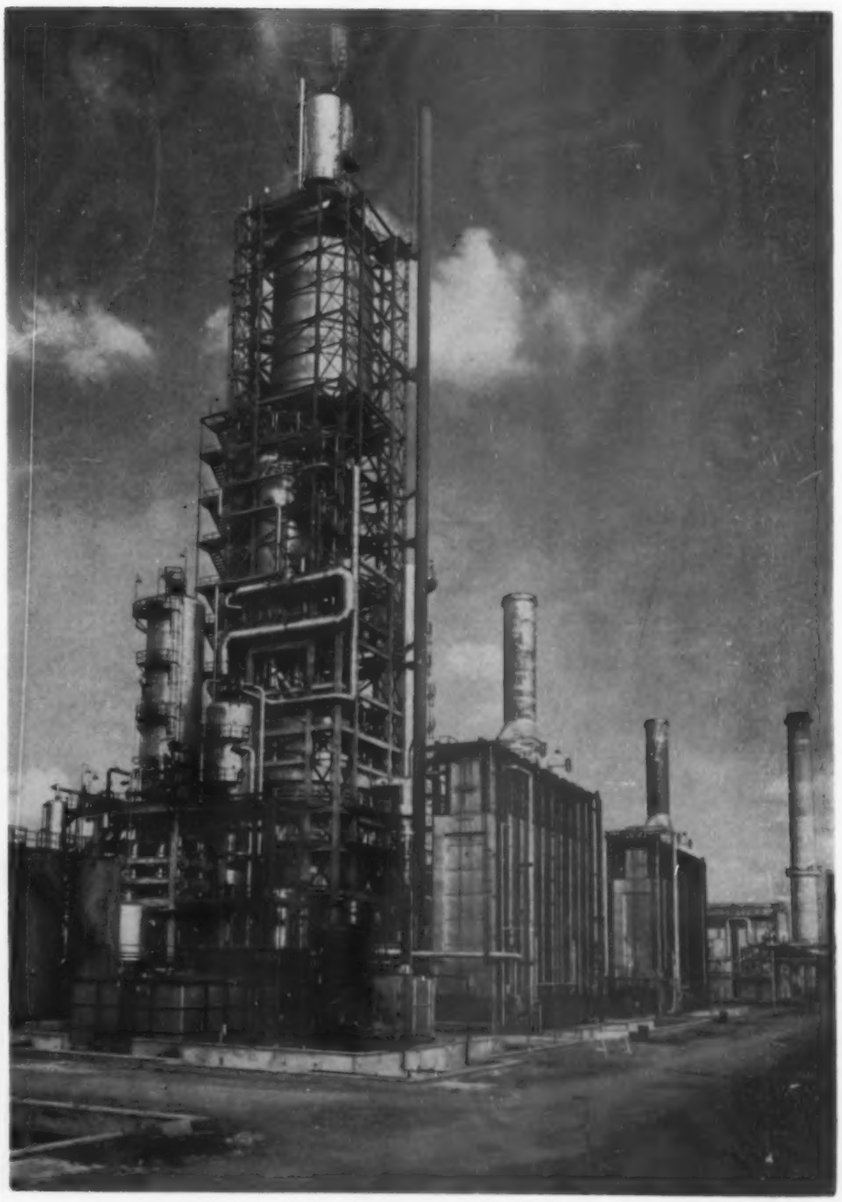
Aerial view of the Condor refinery near the town of Rho, 6.5 miles from Milan.

By M. Moratara

Mario Moratara, managing director of the "Condor" company, began his professional activity in Argentina in 1912 and returned in 1915 to Italy, where he served as an artillery officer for the duration of the first World War. Afterward he was in charge of engineering and construction for the Societa Meridionale di Elettricita in Naples. From 1939 to 1949 he was in the United States with the Consolidated Gas, Electric Light & Power Company of Baltimore, Md. In 1949 he was called back to Italy to serve as managing director of the Terni Company, which operates a group of steel, chemical and electric power plants in central Italy. He assumed his present position in 1951, shortly before construction of the "Condor" plants was begun.

The tank farm at Fegino (Genoa).

View of the topping and TCC units of the refinery.



UNTIL RECENTLY the major petroleum refineries in Italy were all located in the vicinity of main seaports, where tankers could berth. The greatest consumption of petroleum products, however, is concentrated in the inland plains of the Po Valley, and long hauls by road or rail tank cars were therefore required to bring such products to the users in this area.

This condition did not appear economically sound, and the "Condor" company (Condor S.p.A., per L'Industria Petrolifera a Chemica) was established in 1949, with the plan of building a refinery of adequate capacity in the center of Lombardy, near Milan, and conveying the crude oil there from Genoa by pipe line, thus reducing overall transportation costs considerably. To obtain the same results by building a refinery on the coast with pipe lines for conveying the products to the Milan area would obviously have been more costly, because of the need for two separate lines for white and black products.

The main features of the "Condor" plants and installation may be briefly described as follows:

(1) Petroleum dock and storage at Genoa:

In order to secure all-weather berthing for tankers, it was necessary to create facilities for unloading crude oil within the port at Genoa, and to this end, "Condor" made an agreement with the port authority for financing and carrying out the construction of a petroleum dock at the western end of the harbor.

The dock, shown in an accompanying illustration, has two piers, 690 and 770 feet long, respectively, with a water depth of 40 feet so that tankers up to 32,000 tons can berth there. A floating boom in three sections is provided for closing the entrance to the dock while unloading is underway to prevent possible leakage of oil into the harbor area.

For temporary storage of crude oil, a tank farm of 500,000-barrel capacity with

six floating roof tanks was established in the Fegino suburb of Genoa, at a distance of about 2.5 miles from the harbor.

Two 16-inch pipe lines run from the petroleum dock to the tank farm and a booster pumping station is installed at the port for operation in series with the ship pumps. There are four 3,900 gpm centrifugal pumps, of which two are electrically and two diesel-engine driven, and unloading through the twin pipe line can be done up to a rate of 1,500 tons per hour.

(2) Main pumping station and pipe line.

The pipe line carrying the crude oil from Genoa to the refinery is served by a pumping station located in the tank farm at Fegino. There are three electrically driven, 900 gpm, centrifugal pumps furnishing a 1,070 psig head, and three low head centrifugal pumps for transfer of crude oil between tanks.

The pipe line is of 12¾-inch, seamless steel pipe, electrically welded, coated with fiberglass and asphalt saturated asbestos felt, having a total length of about 87 miles and crossing the Apennine range at about 2,600 feet elevation at the Bocchetta pass, nine miles from Fegino. The pipe is buried, over most of its course, at a depth of about four feet and is provided with a system of cathodic protection against electrolytic corrosion. There are several aerial river crossings, of which the principal are over the Po and Ticino rivers: the former is supported by an existing highway bridge, while for the second a 1,000-foot suspension bridge was built, with two non-symmetrical spans to carry the line.

With the present pumping arrangement, the pipe line can transfer up to 50,000 barrels per day of crude oil from Fegino to the refinery; this capacity may be increased when necessary by adding a second pumping station at the Bocchetta pass.

No special equipment, except a scraper trap with two gate valves and a set of pressure and flow recorders, is required at the end of the pipe line, which can be connected directly to each of the six crude oil tanks installed at the refinery. This very simple arrangement was possible because the liquid flow is of the open-channel type over many sections beyond the Bocchetta pass, thus preventing any danger of water-hammer overpressure in case of fast variation or sudden cut-off of the oil flow.

A micro-wave communication system is provided for the pipe line service.

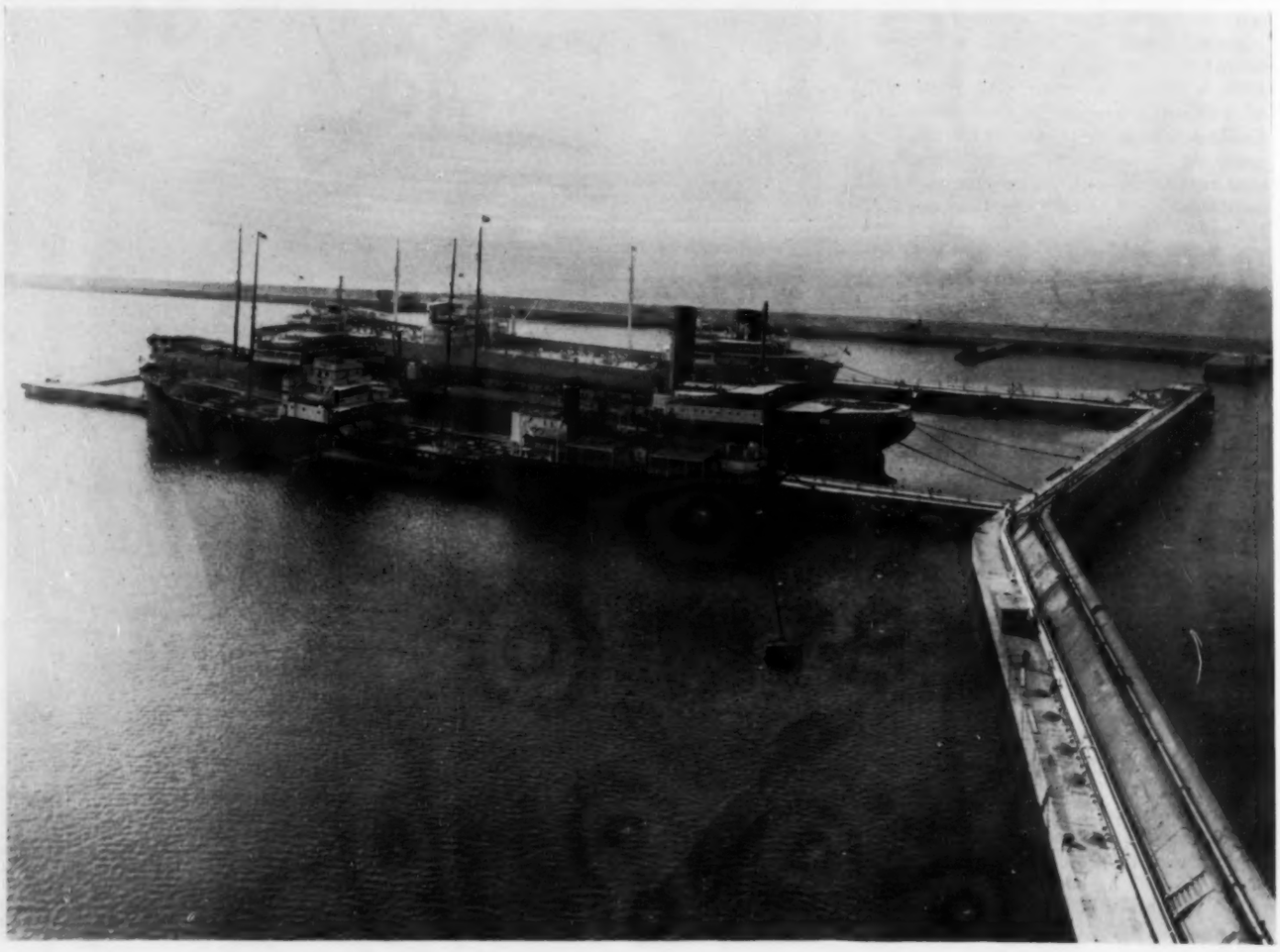
(3) The Refinery

The refinery is located on the Simplon highway near the town of Rho, 6.5 miles from Milan. It covers an area of about 175 acres, part of a plot of 330 acres owned by the "Condor" company. Two main railway lines, from Milan to Turin and to Switzerland via Simplon, run along the northern boundary of the property, and a siding with ample marshalling yards has been built for connection to these lines at the Rho station.

The oil refining facilities comprise four main sections, namely: a 45,000 b/sd topping plant; a 15,000 b/sd catalytic cracking plant (TCC Socony-Vacuum); a gas separation plant and a chemical treatment and purification plant.

The topping plant is provided with a radiant and convection furnace of Born design with 32 vertical burners designed for alternative use of tail gas or heavy residue; the main fractionating tower has a diameter of 15 feet and a height of 150 feet, with 52 trays and four side streams.

The petroleum dock at Genoa.



Pump house of the refinery catalytic section.

Pumping station of the pipe line at Fegino.

There are also a stripping tower, a stabilizing tower, a number of heat exchangers and condensers and a pump house for handling the crude and products.

The catalytic cracking plant includes a feed preparation section, where the residue from the distillation is submitted to vacuum fractionation for separating the heavy distillates to be fed to the TCC reactor. The heating furnace for this section is similar to that of the topping plant, but operates at a higher temperature.

The TCC unit is of the standard air-lift type, with three superimposed main vessels, namely (from top to bottom): hot catalyst bin, catalytic reactor and catalyst regeneration kiln. On the upper part of the structure there is a catalyst surge separator drum, which reaches a height of 266 feet above ground. The reactor has a diameter of 16 feet and a height of 56 feet, and the kiln a diameter of 27 feet and a height of 45 feet.

The catalyst is lifted by an air stream up to the surge separator and then drops by gravity through the reactor to the kiln and then back to the air lift circuit. The regeneration of the catalyst is accomplished by blowing hot air into the kiln, which causes the combustion of the thin layer of coke deposited on the catalyst beads during the reaction. The heat thus generated is used to produce steam in cooling coils installed within the kiln, and this stream is fed to two turbine-driven blowers, providing the air streams for catalyst lifting and combustion in the kiln.

The liquid products obtained from the reactor are separated in a second fractionating tower having a diameter of 14 feet and a height of 106 feet, with 29 trays and three side streams.

A separate pump house is provided for the service of the catalytic cracking plant and between this and the pump house of the topping plant is located the control room with its graphic panel board and centralized control and metering equipment for both plants.

The catalyst circulation is about 350 tons per hour and the normal coke burning capacity of the kiln is rated at 7,500 pounds per hour.

The gas separation plant was installed principally for the purpose of obtaining highly purified streams of propane and butane, which are at present marketed as liquid petroleum gases, but may also in future serve as raw material for petrochemical developments. The plant comprises a compressor section, with four 7,200 cfm gas engine driven units, and eight towers for absorption, separation and purification of liquefiable and permanent gases. There are also a number of heat exchangers, reboilers and condensers and the necessary pumps, which are installed outdoors in a covered space under the supporting structure. A separate control room, with indicating and recording instrument board and automatic or remote control devices, is provided for the gas plant.

The chemical treatment and purification plant provides the following principal treatments:

(a) Acid and caustic treatment for solvent naphtha and kerosine;

(b) Batch clay treatment and filter-press purification for kerosine;

(c) Copper chloride sweetening treatment for gasoline.

The refinery utilities and services include:

(a) The steam and electric-power plant comprises three 100,000-lb. per hour boilers, generating steam at 800 psig pressure; two three-phase 4,200 Kw, 3,000 V, non-condensing steam turbine generators, discharging steam at 170 psig pressure for all refinery services; and an electric distribution switchboard, of the metal-clad type, for 3,000 V and 500 V distribution. For extreme emergency electric supply, a 4,000 KVA substation was installed, which is connected to the high-voltage distribution system of one of the public utilities in the area.

(b) Water circulation and refrigeration plant having a capacity of about 22,000 gpm. There are a number of electrically driven and steam-turbine driven centrifugal pumps providing full spare capacity. For the fire fighting service, a special distribution system is installed, which can be fed at 170 psig pressure by three gasoline engine driven centrifugal pumps. Circulating water is cooled by four refrigerating towers with mechanical induced draft.

c) Four pump houses for transfer of crude oil and products and an outdoor pumping station for LPGas.

(d) Ethylation plant.

(e) Loading racks for delivery of all refinery products into railway or road tank cars. These were designed to handle the entire refinery production, there being no other means of delivery.

(f) A chemical laboratory for routine check of production and technical investigations.

(g) A complete fire-fighting system, consisting of a buried pipe network with hydrants located at frequent intervals for supply of high pressure water. Each tank is provided at the top with a perforated pipe ring for cooling in case of fire and with an adequate number of foam distributors carrying the foam directly over the floating roof or inside cone roof of the tanks. Two fire engines with foam generators and spray nozzles are available.

The storage facilities of the refinery consist of 65 electrically-welded steel tanks having a total capacity of about 2,300,000 barrels with individual capacities ranging from 7,500 to 95,000 barrels, the latter being used for crude oil (six) and gasoline (two) tanks. Floating-roof tanks were adopted for all crude oil and gasoline storage, while the cone roof type was used for other products. For LPGas storage there are two 5,000-barrel spherical tanks for butane and six 600-barrel cylindrical tanks for propane; additional capacity is now being installed.

(4) Financing, engineering and construction:

"Condor" is an independent company financed by Italian capital, and its operating staff is entirely Italian.

Detailed engineering design and supervision of construction for the refining units were carried out by Stone & Webster Engineering Co. through E. B. Badger & Sons Ltd. of London, England, under license and supervision of Socony-Vacuum Oil Co. for the TCC section. Petrocarbon Ltd. of Manchester was the consultant on general design, and Will G. Heltzel of Tulsa, Okla. was consultant for pipe line design and construction.

All civil engineering and utilities design was carried out by the technical staff of "Condor," which also had charge of supervision of construction. Erection work, civil construction, pipe line welding and installation were handled by Italian contractors. First foundation work was started in December 1951 and the refinery went on stream in August 1953.

Royal Dutch/Shell Group reports expanding operations

ROYAL DUTCH/SHELL GROUP

Financial Data		1953	1952
Gross Income	£	1,700,714,000	1,616,616,000
Net Income	£	130,413,000	125,605,000
Capital Expenditure	£	220,000,000	188,000,000
Capital invested and earnings retained in the Group	£	871,500,000	767,580,000
Long-Term Borrowings	£	161,306,000	166,839,000
Net Working Capital	£	456,181,000	408,425,000
Cash and Securities	£	315,076,000	261,698,000
Operating Data			
Gross production of crude oil	Bbls.	489,300,000	474,000,000
Crude oil received under long term contracts	Bbls.	127,500,000	124,900,000
Total	Bbls.	616,800,000	598,900,000
Crude Oil Processed	Bbls.	626,200,000	607,700,000

NET INCOME of the Royal Dutch/Shell group of companies increased £4.8 million ($13,488,000) in 1953 to £130,413,373 ($366,461,578). Activities of both the Dutch and British operating companies making up the group were expanded and a policy of major investment in new facilities was continued.

The Royal Dutch/Shell group comprises a large number of companies, in which Royal Dutch Petroleum Co. and Shell Transport and Trading Co. Ltd. participate in the ratio 60:40. These two are the "parent companies" of the group and are purely holding companies. Directly under these two are three companies, the shares of which are held entirely by Royal Dutch and Shell, which are the parent operating companies. They are N.V. De Bataafsche Petroleum Maatschappij (a Netherlands company having its head office at The Hague), The Shell Petroleum Co. Ltd. and The Anglo-Saxon Petroleum Co. Ltd. (both British companies with head offices in London). The proceeds of the operations of these three companies and of their investments provide practically the whole income of the two parent holding companies.

Royal Dutch has been contemplating the listing of its shares on the New York Stock Exchange. Negotiations have resulted in an agreement in principle on methods of meeting Exchange requirements.

Capital expenditures of the group in 1953 totaled £220 million compared with £188 million in 1952 and £164 million in 1951. Income from the various branches of the industry was as follows:

	MILLIONS OF POUNDS STERLING		
	1953	1952	1951
Exploration & Production	101	96	88
Manufacturing	72	51	45
Marketing	30	30	24
Marine	13	6	3
Miscellaneous	4	5	4

The group produced 489.3 million barrels of crude in 1953, compared with 474 million in 1952 and 430.1 million in 1951. Production was 78 percent of crude processed in both 1953 and 1952. In 1951, group production was about 75.5 percent of crude runs to refinery stills. Daily average production of 1.3 million barrels in 1953 was about 10 percent of the world's supply.

Sales of oil products increased 1.4 million metric tons in 1953 to 84.9 million tons. Sales of chemical products rose 450,000 tons 1,550,000 tons, an increase of 41 percent. On a volume basis, chemical product sales were 1.8 percent of oil sales. Monetary percentage was, of course, much greater.

The group also showed a remarkable increase in sales of natural and refinery gases. The total in 1953 was 239.4 trillion cubic feet, compared with 190.1 trillion in 1952, an increase of 26 percent.

In 1953 the group organized Shell Tankers Ltd., a new company, to operate Shell's tanker fleet. At the end of the year the fleet consisted of 509 vessels of 2,000 dwt and over of which 2.5 million tons was owned and the remainder chartered. Five new 18,000-ton tankers were delivered last year and five more will go into service before the end of 1954. Shell engaged in a tanker building program which will increase its owned fleet of 3.5 million tons.

In his annual message to stockholders, Sir Frederick Godber, chairman of Shell Transport and Trading Co. Ltd., noted that the group normally expected to earn a profit on its ships, but that in 1953 the contribution to earnings was small because of a drop of some 40 percent in ocean freight rates. The cut was brought about by the increase of 3.75 million tons in the world's tanker fleet.

Tanker life has been extended to an average of about 30 years, but it is anticipated by the group management that scrapping will be accelerated in the next few years as new vessels capable of more economical operation make continuance of obsolescent tankers in service unattractive to owners.

Crude and products pipe lines in which the group has an interest added more than a thousand miles of line in 1953. Crude line mileage increased 950 miles to 10,050 and products line mileage 550 to 4,700 miles.

Group refineries were expanded in many parts of the world. In Canada the Vancouver refinery was enlarged and plans were drawn for expansion at Montreal. In the United States an active building program was under way; crude runs to stills increased eight percent and a large new refinery for the Pacific Northwest was planned.

In Latin America the group increased the capacity of the Cardon, Venezuela plant from 34 to 53 million barrels per year. New lube plants were being built in Argentina and Curacao.

In Asia and the Far East, group activities were increased. A start was made on the new refinery at Bombay which is to be half owned by the group. In Japan a half interest was purchased in a Japanese refining and marketing company. The new Geelong refinery in Australia was brought to completion and was recently put on stream.

Crude runs in Europe increased nearly five million barrels to 159 million. A new crude unit a Pernis-Rotterdam brought capacity of that plant to 65 million barrels per year. Both crude and cracking capacity was increased in France. A catalytic reforming unit was built at Stanlow in England.

Chemical plants of the group operated in excess of rated capacity throughout the year. New plants were brought into production in California, Texas and Holland. Added capacity was activated in other areas.

Group crude production was increased more than 60 percent in the past five years. Reserves have continued to increase year by year despite greater withdrawals.

Discoveries of new fields were made in Canada, the United States, Holland, Germany, Nigeria and offshore Borneo.

Management officials of the group companies are looking forward to a period of further active expansion in the years to come and anticipate even keener competition than in the past.

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it now powers the world!
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to worldwide service in 1954
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developments have kept pace
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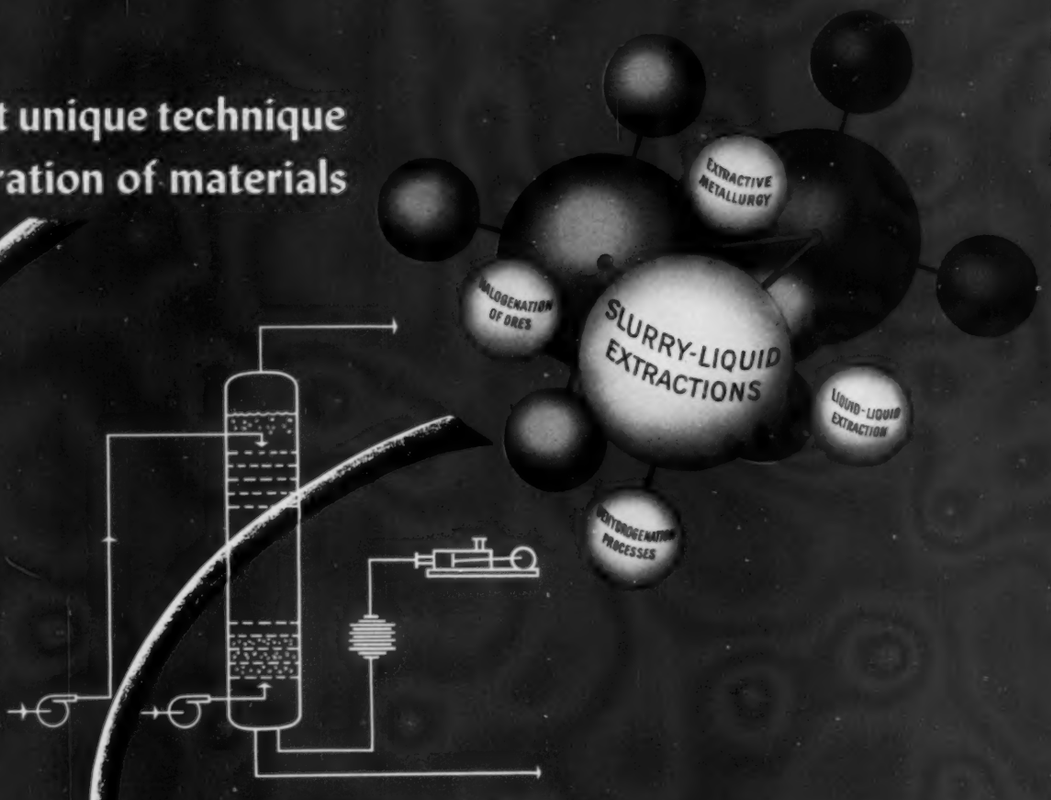

Schematic Diagram of Pulse Column

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Brazilian Council extends exploration

By R. G. Walker

THE PETROLEUM COUNCIL of Brazil recently began drilling a fifth wildcat in the state of Para in the Tapajos Basin, at Alter do Chao, municipality of Santarem. Two rigs are now working simultaneously for the first time in the Amazon Valley, the first at Nova Olinda, in the Madeira Basin. The Nova Olinda well is being continued to a depth of 11,000 feet in order to ascertain definitely if oil exists in commercial quantities, although prospects are now less promising than they appeared to be at 3,000 feet. An American expert expresses the opinion that oil will be found in this region, although perhaps not at Nova Olinda, owing to the presence of many favorable indications.

Sixty-eight wells were drilled during 1953 in Bahia, 52 yielding oil and four gas. The corresponding figures for 1952 were 56, 38 and two. Wells drilled in all areas to December 31, 1953 total 379, of which 232 produce oil and 28 gas, while 94 are dry and 25 were stratigraphic bores drilled to explore formations. Of the total, 360 are located in Bahia, seven in Alagoas, four in Sergipe, three in Para, two in the Acre territory, two in Maranham and one in Sao Paulo. When the new year opened, the Council was still drilling two wells in Bahia, one in Amazonas, one in Maranham and one in Parana. The last-named has since been abandoned. The footage drilled increased from 40,638 meters in 1952 to 50,362 in 1953, making a total of 308,772 meters to December 31.

The new Bahia field at Agua Grande, municipality of Catu, is producing an average of 2,000 barrels daily and is believed to be one of the best discoveries in the Reconcavo zone. In the Pojuca area of Bahia, the first pioneer well yielded oil in good quantity at 1,400 meters.

During 1953 a pipe line was completed connecting the Dom Joao to the Candeias field for conveying crude to the Mataripe refinery. A second duct, 80 kilometers long, is planned to carry crude from the Agua Grande and Mata de Sao Joao fields to Mataripe.

The decree approving the statutes of Petrobras was signed by President Vargas at the end of March. The Union will exercise a monopoly in prospecting for and exploiting oil deposits through the National Petroleum Council, as the directing and supervising organ, and through Petrobras and its subsidiaries as organs of execution. The company's initial capital of 3,125 million cruzeiros ($171,875,000) is formed by the Union's properties, including the Reconcavo oil and gas wells, the assets of the Bituminous Schist Commission, the Mataripe and Cubatao refineries, the fertilizer factory, now under construction, the Brazilian tanker fleet and the Petroleum Council's materials and equipment.

Successive increases will raise the capital to 10,000 million cruzeiros ($550,000,000) by 1957. These increases will be contributed by federal, state and municipal public entities from the proceeds of the sole tax on liquid fuels and by private individuals who will participate through payment of the tax on motor vehicles until 1957, or by voluntary purchases of shares.

The Union will always hold a majority of the voting shares. All stock will be nominative, either common voting or preferential non-voting and inconvertible. Preferential stock will be guaranteed a minimum interest of five percent. Only native-born Brazilians, or foreigners naturalized for more than five years, either single or not married to foreigners under the regimen of property in common, may be shareholders.

As the Union is at the moment the only shareholder and the Administrative Council can only be formed when others are admitted, subscription lists have been opened to raise the capital to 6,000 million cruzeiros ($330,000,000) without delay.

President Vargas has nominated Col. Juracy Magalhaes as president of the Administrative Council of Petrobas. Sr. Irnack Carvalho do Amaral, Col. Arthur Levi and Sr. Joao Tavares Neiva de Figueiredo have been appointed directors, with three, two and one year mandates, respectively. Col. Magalhaes is at present military attache to the Brazilian Embassy in Washington. He was for some time president of the state-owned Vale do Rio Doce (Itabira) mining company and was formerly governor of the state of Bahia.

The Special Commission, under Engineer Plinio Cantanhede, president of the Petroleum Council, recommends the following proposals for the supply of crude to the Cubatao refinery:

(a) Esso Export Corp. and California Transport Corp. to supply, respectively, 30,000 barrels daily of RECON type petroleum and 15,000 b/d of stabilized Arabian, the buyer to have the option of increasing these quantities to 45,000 and 20,000 b/d.

(b) Signing of the contracts to be conditional on the proposers' agreement to the following points:

As regards Esso Export Corp.: All the advantages which, in the tender, were stipulated for the entire supply to be maintained, including credits for the building of a maritime terminal; credit facilities to be equal to those of the tender most favorable in this respect; the contract to include specifications minutely defining the characteristics of the special type of crude offered.

As regards California Transport Corp.: Preference to be given to Brazilian tankers for transshipment services; reversion, in the buyers favor, of transshipment charges as from the date the maritime terminal begins operating; and suppression of the suppliers' option to substitute the oil specified in the tender.

As regards both suppliers: Preference is to be given to tankers of the Brazilian petroleum fleet or, if this is impossible, to vessels sailing under the Brazilian flag; fuel for transportation to be purchased from the Cubatao refinery and paid for in dollars.

As of February 1, the sole tax on petroleum products must be paid by all public entities, as well as by private consumers. Prices are thus equalized and increased resources are assured for the fund into which the tax is paid.

President Vargas has instructed the Minister of Communications and Public Works to consider the possibility of establishing direct steamship communications between Brazilian and Venezuelan ports, in order to foment trade relations between the two countries. Brazil, whose exports to Venezuela are negligible, imports petroleum products to the value of 186 million cruzeiros ($10,230,000) annually from that country and hopes to pay for them, at least partly, in Brazilian merchandise.

A contract has been signed between the administrators of the Brazilian oil fleet and Ferguson Brothers, of Glasgow, for the building of a 1,200-ton tanker, speed 11 knots, at a cost of £237,000. Delivery is scheduled for December 1955.

The administrators of the Santos-Jundiai Railway, concessionaires of the Santos-Sao Paulo pipe line, have been authorized to contract a loan of 76 million cruzeiros ($4,180,000) with the Brazilian Bank for Economic Development. The advance will be used to build a 12-inch line to carry petroleum from the Cubatao pumping station to the Uniao refinery, now building at Capuava, 12 kilometers distant; also, eight and 14-inch supplementary lines to convey light products and fuel oil between the Uniao refinery and Capuava-Utinga terminal of the Santos-Sao Paulo pipe line.

Congress has approved the payment of 78,095,264 cruzeiros ($4,295,225), Brazil's contribution to the expenses of the Mixed Commission appointed to concert measures for joint exploitation of Bolivian oil.

The products pipe track at Vacuum Oil Company's new refinery at Coryton in Essex.

Coryton Refinery

(Continued from page 37)

is de-aerated prior to extraction to avoid oxidation of the solvent. Products from this step are the raffinate and extract, both mixed with solvent.

To separate furfural from the raffinate it is first heated and dry vacuum-flashed, in which step most of the furfural content is recovered in a dry condition; the raffinate is then stripped with steam to get out the last traces of furfural. The separation of furfural from the extract follows practically the same course, with the exception that prior to vacuum-flashing it is pressure flashed. The furfural recovered from the pressure and vacuum flashings goes direct to storage for further use.

The steam-stripped furfural, which is mixed with water, is subjected to azeotropic distillation to separate the two, the dry recovered furfural passing back to storage for further use. After being freed from furfural, the extract is used as part of the feed stock for the catalytic cracking unit.

In the MEK-Toluol de-waxing section, block treatment is carried out as in the case of the furfural extraction. The MEK-Toluol solvent is mixed with the oil and cooled in chillers, using propane as refrigerant. Under these conditions the waxy content of the oil solidifies or crystallizes. The solids are separated and removed as slack wax mix on rotary filters.

The solvent is recovered from the filtrate and from the slack wax mix by similar methods. The first and second stages of evaporation are carried out in kettle-type evaporators and the residue is then preheated and dry flashed. Final removal of solvent from both dewaxed oil and slack wax is by steam stripping. The wet solvent is then recovered for further use by azeotropic distillation. Micro-crystalline wax is obtained by further MEK-Toluol treatment of the oily petroleum (slack wax) obtained from bright stock. From all other stocks the slack wax is sent as feed for the TCC unit.

The Thermofor continuous percolation process, of which the Coryton installation is the first commericial unit of its kind in the world, is the subject of an article by the technical staff of the refinery appearing on other pages of this issue.

The lubricants made in this refinery are basic grades which are used for blending to the well-known international brands of "Gargoyle" and "Mobiloil" lubricants and are shipped by barge and coastal tanker to the company's blending stations at Wandsworth and Birkenhead. No finished blends of lubes are delivered from the main plant. All black and white fuels, however, are despatched direct from the refinery.

The main engineering and construction of the refinery was directed by The Lummus Co. Ltd. Under their supervision, site preparation and civil engineering were undertaken by John Laing & Son and Sir Robert McAlpine & Sons Ltd. Much of the mechanical work was done by Costain-John Brown Ltd. More than a thousand sub-contractors and suppliers of equipment contributed in one way or another to the completed plant.

In the boiler house there are three 180,000-pound per hour water tube boilers working at 600 psig made by International Combustion Ltd. The water used for steam is obtained from the Southeast Essex Water Board's supply and is conditioned by hot lime and hot zeolite treatment of the Permutit Co., the resulting water having a zero hardness figure.

Power is generated by 3 x 5,000-kw turbo-generators made by Metropolitan Vickers Ltd., generating at 11,000 v., 50 cycle, three phase. This is stepped down to 3 300 v. for motors of 200 hp and over, to 450 v. for motors under 200 hp and to 220-250 v. for lighting. The turbines have passout steam at 125 lbs. and 20 lbs. for the required process steam.

Circulating water for all cooling purposes or for fire fighting is drawn from the Thames, the pumps for its distribution being located on a special caisson built by John Laing & Sons, which is sunk offshore. The water requirement for these purposes amounts to 40,000,000 imperial gallons per day.

The water for cooling at the power house, included in this quantity, has its own pumping service and is discharged directly to the river, as it is not oil-polluted.

The circulating water for refinery cooling and fire service is returned to the river at another point, but in its return has to pass through the separator system, where all traces of oil are removed before its re-entry into the river. The separation consists of a skimming system, API separator, oil recovery, emulsion breaking and settling. Water for domestic and process purposes is drawn from the same source as the water used in the boilers.

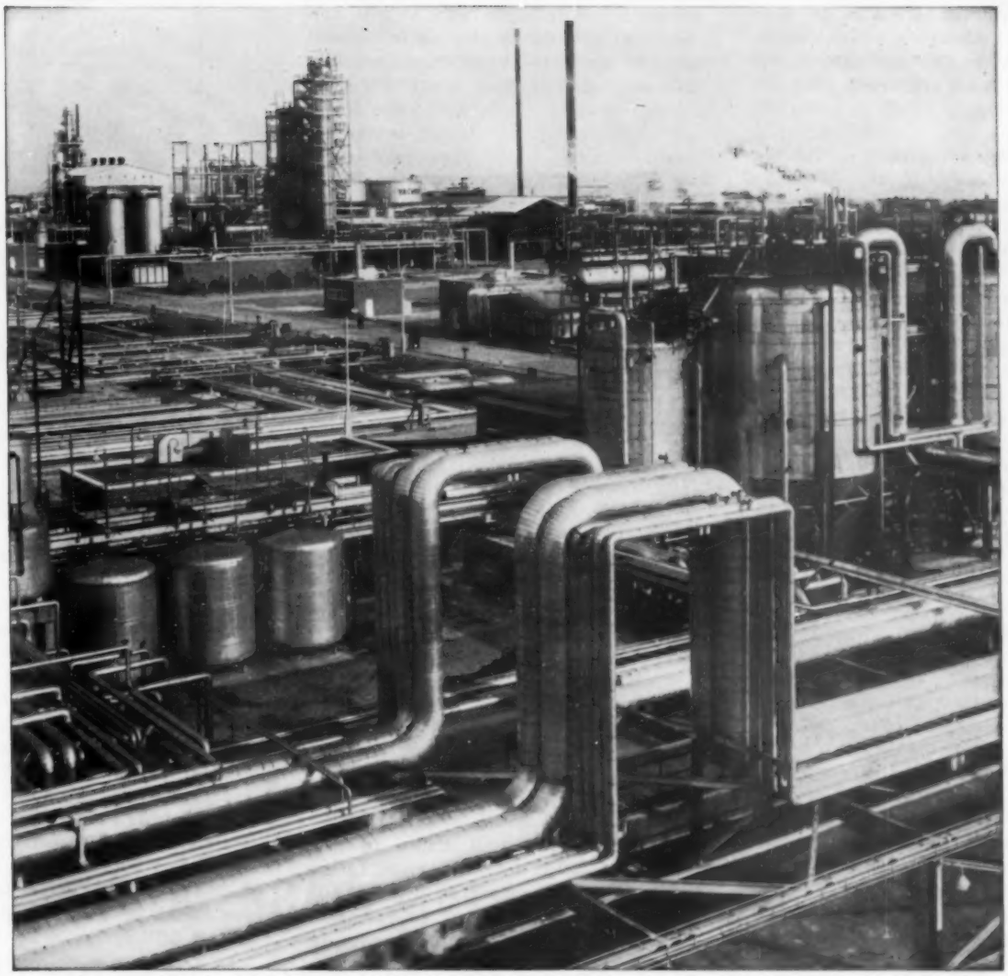
The water supply for fire fighting is drawn from a ring main, the pressure in which is kept constant at 150 lb. for supplying the hydrants. A mobile fire engine and several foam machines provide additional fire protection.

A fully-equipped first aid department is maintained with a visiting doctor, a resident nurse and 24-hour service by a full first aid crew.

Maintenance and repairs are taken care of by fully equipped and staffed repair shops for all trades. Full stores are maintained as well as garage and repair shops for automobiles.

Fifty houses on the site provide accommodations for the key staff, while in addition a certain number of dwellings in the new town of Basildon have been reserved for employees of the refinery. The Coryton Institute provides indoor diversion for the refinery personnel and a sports and recreation section is in course of formation.

The housekeeping in the refinery area receives special attention. All sections of the refinery are kept scrupulously clean and free from any litter, while the roads and open spaces are in keeping with the high standards of the rest of the plant. These open spaces consist either of well-kept lawns or flower gardens, which in springtime are a delight to the eye.



Oil Refinery at Coryton

Civil engineering and building work for this important project has been carried out by the company for Vacuum Oil Company Limited at Coryton. Heavy concrete foundations, reinforced concrete structures, piling, roads and drainage, and the water intake works and jetty were all completed on schedule time.

The water intake was constructed in reinforced concrete on the Mulberry harbour principle at Gravesend and Tilbury and floated down the Thames to the refinery.

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Oil Finding Cost at New Peak Level

(Continued from page 45)

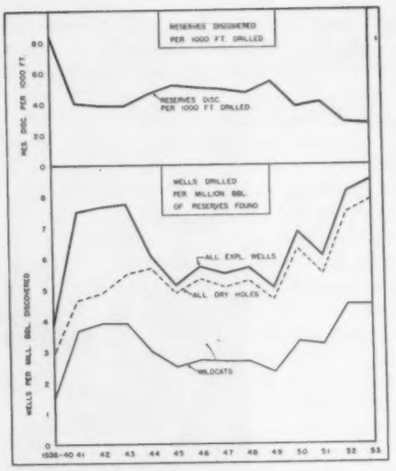
serves, above original estimates, has been on the order of about six billion barrels annually. Thus, the 1953 estimate of 34.5 billion barrels may ultimately prove to have been on the order of at least 40.5 billion barrels.

First estimates are usually on the low side and are subsequently revised in the light of later developments. In computing oil finding costs, first estimates of reserves found in new fields and oil found by extension drilling are the factors used in determining the initial unit cost of finding oil. However, as revisions are made in subsequent years, it is necessary to allocate this oil back to the years of original discovery, in order to reflect the ultimate average cost of the original discoveries. Table II shows the initial as well as the revised cost of finding oil since 1944, and 3-year moving averages of such costs since 1933. In the 3-year period, 1950-52, the initial finding cost was 76.9 cents per barrel, but subsequent revisions in first estimates added 1,029 million barrels during this period. This resulted in a revised cost per barrel of 55.2 cents, since the divisor of net working interest oil proved to be greater than the original estimate of oil found. Revisions are usually credited to immediately preceeding years, but sometimes extend back over a much longer period. It will be recalled that first estimates of reserves in the East Texas field were far too low, and were revised over a period of several years, until the ultimate recovery attained a total of more than five billion barrels. Some of the writer's earlier surveys of oil finding costs reflected these and other subsequent revisions, which extended back over a period of 10 or 12 years.

A fact that many outside of the petroleum industry do not realize is that replacement costs of oil in the underground reservoirs are going up and that a substantial share of the oil produced today was previously found at considerably lower initial costs. In other words, the oil industry is taking out of the reservoirs oil that originally cost about 20 cents per barrel, which is being replaced with new reserves that now involve an initial cost of $1.80 per barrel. From these facts it is obvious that future oil production must involve increasingly higher costs. Every active oil producing company in the nation is plowing back increasingly larger sums for exploration in order to insure adequate future supplies of oil. Many of the major oil companies are making these facts known to their stockholders and placing particular emphasis upon the extremely high costs of exploration. Without some compensating economies in the production and utilization of crude oil, it is obvious that the accumulation of these high costs must ultimately be reflected in higher prices.

In 1953, the oil industry drilled a total of 52,210 wells, of which 19,850 were dry holes. In wildcat drilling, in the search for new oil reserves, the dry hole ratio was 6.6 dry holes to one producer. In relationship to all exploratory drilling, including new fields and extensions to old fields, the ratio of all dry holes drilled in exploration and development was 11.4 to each oil producer completed. In development drilling, however, the incidence of dry holes was only 1.6 to one development producer. In the combined exploration and development drilling operations, dry holes comprised an average of 40 percent of all wells drilled in 1953.

The average quantity of new reserves found per wildcat well drilled in new fields in 1953 was 486,000 barrels. In the last six years the average was 565,000 barrels per producing well. In extension drilling, the reserves found per producing well completed in 1953 was 5,935,000 barrels, while the average per well for the past six years amounted to 7,644,000 barrels. Combined discoveries in 1953 averaged 1,460,000 barrels per well in 1953 and an average of 1,873,000 barrels per well in the past six years. An index of reserve discoveries, using all exploratory


RESERVES DISCOVERED PER 1000 FT. DRILLED
RESERVES DISC. PER 1000 FT. DRILLED
WELLS DRILLED PER MILLION BBL. OF RESERVES FOUND
ALL EXPL. WELLS
ALL DRY HOLES
WILDCATS
WELLS PER MILL. BBL. DISCOVERED
1936-40 41 42 43 44 45 46 47 48 49 50 51 52 53

wells drilled, shows that the average quantity of reserves found per well in 1953 amounted to 112,000 barrels, while the average for the past six years was 150,000 barrels per well drilled. These figures offer a guide to expectancy in the future, based upon the drilling program for any given year.

While the oil industry drilled the greatest exploratory footage in its history during 1953, a total of 94.5 million feet, the footage per thousand barrels of oil found was also the greatest in the industry's history. In 1953, the industry drilled 37,562 feet of exploratory hole per million barrels of oil found, which compares with a pre-war (1936-40) average of only 11,904 feet per million barrels. Reserves discovered per thousand feet of exploratory hole drilled in 1953 amounted to 27,000 barrels against an average pre-war of 84,000 barrels per thousand feet of hole drilled.

In 1953 is was necessary to drill 8.57 wells per million barrels of oil found, compared with an average of only 3.99 wells per million in pre-war years. Furthermore, it took nearly eight dry holes to lead to the discovery of a million barrels of reserves, whereas in the pre-

(Continued on page 62)

TABLE VI

RESERVES DISCOVERIES RELATED TO DRILLING AND FOOTAGE

Year	New Res. Disc.* (Mill. Bbl.)	Wildcat Drilling Wells Drilled	Wildcat Drilling Wells Per Mill. Bbl.	All Dry Holes Holes Drilled	All Dry Holes Wells Per Mill. Bbl.	All Expl. Wells Wells Drilled	All Expl. Wells Wells Per Mill. Bbl.	Footage Drilled Total Footage (Thous.)	Footage Drilled Footage Per Mill. Bbl.	Footage Drilled Res. Disc. Per 1000 Ft. (Thous. Bbl.)
1936-40 (Avg.)	1,603	2,469	1.54	4,781	2.98	6,400	3.99	19,083	11,904	84
1941	980	3,552	3.62	4,519	4.61	7,389	7.54	23,945	24,433	41
1942	779	3,061	3.93	3,772	4.84	5,946	7.63	19,919	25,570	39
1943	862	3,384	3.93	4,719	5.47	6,702	7.77	22,552	26,162	38
1944	1,243	3,733	3.00	7,010	5.64	7,503	6.04	27,278	21,945	46
1945	1,581	3,975	2.51	7,646	4.84	8,187	5.18	30,626	19,371	52
1946	1,635	4,470	2.73	8,764	5.36	9,403	5.75	33,019	20,195	50
1947	1,892	4,994	2.64	9,599	5.07	10,401	5.50	38,365	20,277	49
1948	2,270	6,060	2.67	11,890	5.24	12,850	5.66	48,193	21,230	47
1949	2,798	6,669	2.38	12,912	4.61	14,025	5.01	51,626	18,451	54
1950	2,382	7,831	3.29	15,024	6.31	16,249	6.82	62,138	26,086	38
1951	3,102	9,935	3.20	17,180	5.54	18,760	6.05	75,903	24,469	41
1952	2,372	10,600	4.47	17,710	7.47	19,350	8.16	84,635	35,681	28
1953 (p)	2,516	11,089	4.41	19,850	7.89	21,573	8.57	94,505	37,562	27

* New fields and extensions.
(p) Preliminary estimates.

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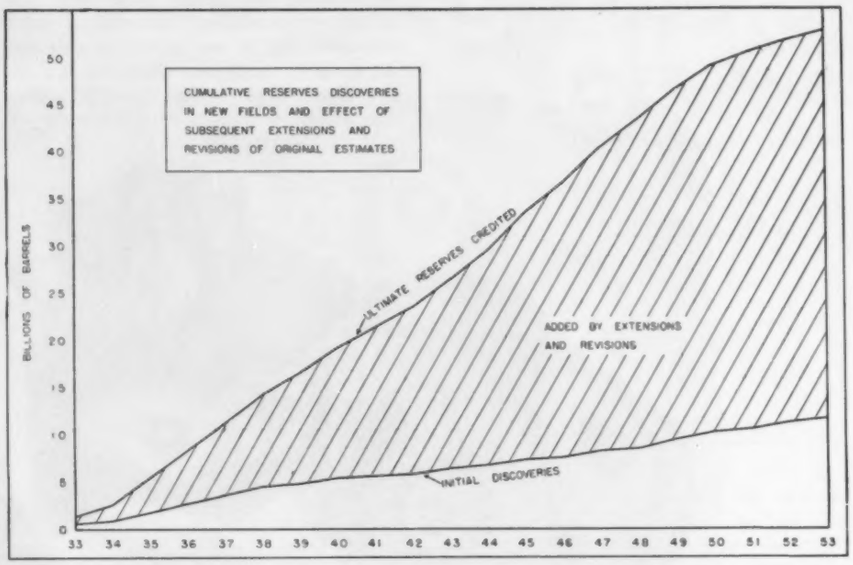
Oil Finding Cost at New Peak Level

(Continued from page 60)

war years the rate was less than three dry holes per million barrels. In wildcat operations the industry drilled 4.41 wells per million barrels of new reserves found, against only 1.54 wells in the pre-war period. These facts, shown in Table VI, emphasize the hazards attending today's search for new oil reserves and place particular emphasis upon the remarkable achievements of the oil industry in maintaining the nation's oil reserves at adequate levels.

The degree to which extensions and revisions have played such an important part in keeping the nation's reserves at a safe margin above year-to-year requirements is clearly demonstrated in Table VII. The ever-widening spread between initial oil discoveries and ultimate reserve credits exemplifies the importance of spending large sums in efforts to extend the limits of oil fields discovered from year to year. It demonstrates the persistency of oil men to probe to the limit any and all possibilities of locating and developing the maximum quantities of reserves available for future needs. These facts are particularly significant in appraising the long-range outlook for future supply and provide an index of expectancy from the initial discoveries in any particular year.

The outlook for oil is highly favorable for many more years to come. Those who say we are running out of oil in the United States should re-evaluate their opinions. There is still plenty of oil to be found in the nation, and it will be found providing that the oil industry is permitted to work out and pursue its immediate and future objectives.



To insure the utmost in accomplishment, however, it is necessary for the people and the lawmakers to understand the many problems that confront the industry. It is indeed unfortunate that the oil industry has been singled out for criticism by those who do not have a full appreciation of the importance of petroleum to the national welfare. Oilmen, like everyone else, are in business to make money, but the facts prove beyond any doubt that it takes a tremendous outlay of capital to stay in the oil business and the risks are far more hazardous than in most other lines of endeavor.

Those who condemn the depletion allowance in the oil industry should try their luck in the search for a new oil field. After they have drilled six or seven dry holes, at a cost of more than $100,000 each, they may have a better conception of the oil industry's need for an adequate depletion allowance.

An adequate price for oil and a minimum depletion allowance of 27½ percent offer the best guarantees for an adequate future oil supply and a secure America in times of peace or war.

TABLE VII

U. S. PETROLEUM LIQUIDS RESERVES, DISCOVERIES AND PRODUCTION

(Million Barrels)

Year	Res. Jan. 1	Discoveries: New Pools	Discoveries: Ext. & Revis.	Discoveries: Total Oil Added	Prod.	Net Incr.	Allocation of Ext. & Revisions	Ultimate Credits to Orig. Res.	Adjusted Reserves Dec. 31	Ratio Ult. Credits to Orig. Disc.	Cumulative: Initial Disc.	Cumulative: Ultimate Credits
1933	14,335	350	300	650	939	—289	884	1,234	17,177	3.52	350	1,234
1934	14,046	614	531	1,145	945	200	921	1,535	17,767	2.50	964	2,769
1935	14,246	955	330	1,285	1,036	249	1,620	2,575	19,306	2.70	1,919	5,344
1936	14,495	860	950	1,810	1,142	668	1,988	2,848	21,012	3.31	2,779	8,192
1937	15,163	940	2,850	3,790	1,328	2,462	1,878	2,818	22,502	3.00	3,719	11,010
1938	17,625	825	2,325	3,150	1,265	1,885	2,373	3,198	24,435	3.88	4,544	14,208
1939	19,510	360	2,140	2,500	1,317	1,183	2,042	2,402	25,520	6.67	4,904	16,610
1940	20,693	315	1,685	2,000	1,409	591	2,162	2,477	26,588	7.86	5,219	19,087
1941	21,284	455	1,620	2,075	1,483	592	1,907	2,362	27,467	5.19	5,674	21,449
1942	21,876	280	1,700	1,980	1,470	510	2,017	2,297	28,294	8.20	5,954	23,746
1943	22,386	345	1,265	1,610	1,594	16	2,425	2,770	29,470	8.00	6,299	26,516
1944	22,402	515	1,574	2,089	1,778	311	2,825	3,340	31,032	6.49	6,814	29,856
1945	22,713	440	1,870	2,310	1,836	474	3,212	3,652	32,848	8.30	7,254	33,508
1946	23,187	323	2,370	2,693	1,850	843	2,840	3,163	34,161	9.79	7,577	36,671
1947	24,030	505	2,211	2,716	1,988	728	3,013	3,518	35,691	6.97	8,082	40,189
1948	24,758	461	3,805	4,266	2,167	2,099	2,528	2,989	36,513	6.48	8,543	43,178
1949	26,857	983	2,592	3,575	1,999	1,576	2,246	3,229	37,743	3.28	9,526	46,407
1950	28,433	623	2,706	3,329	2,154	1,175	2,000	2,623	38,212	4.21	10,149	49,030
1951	29,608	465	4,673	5,138	2,453	2,685	1,097	1,562	37,321	3.36	10,614	50,592
1952	32,293	578	2,728	3,306	2,513	793	755	1,333	36,141	2.31	11,192	51,925
1953(p) ..	33,086	688	3,352	4,040	2,602	1,438	297*	985*	34,524	1.43	11,880	52,910
1954(p) ..	34,524	—	—	—	—	—	—	—	—	—	—	—
Totals		11,880	43,577	55,457	35,268	20,189	41,030	52,910	—	4.45	—	—

(p) Preliminary estimates.
* To balance reserves Dec. 31, 1953, subject to subsequent revision.

Source: Joint Committee on Reserves of the American Petroleum Institute and American Gas Association.
Allocations and adjusted reserves computed by author.
Note: Slight differences are due to author's revisions and interpolations of original committee data.

A Cuban company recently brought in a 200 B/D discovery well — the No. 1 Echevarria, located in the Jatibonico Basin of South Central Cuba — as the first sedimentary production in Cuba. Exploration Surveys International Inc. is gratified that this important new discovery strike in Cuba was located solely on data we obtained.

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If you contemplate going into this important new region, or if you plan to broaden your present holdings there, consult with E.S.I.I. first. In field work, in the correlation of gravimetric, seismic and geologic data, and in the final evaluation and interpretation of these surveys, our thorough knowledge of Cuba is well worth considering. E.S.I.I., with its excellent field facilities, is capable of handling any type of geophysical program. We'll be glad to furnish full particulars about our many services without obligation, of course. Write to 5615 Daniels Avenue, or telephone EMerson-6663, in Dallas, Texas.

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BRITISH OIL NEWS

By E. Lawson Lomax

Announcement of an agreement between the government of Saudi Arabia and Greek ship owner Aristotle Onassis for the formation of a shipping company to handle the transportation of Arabian oil has caused a decided flurry in British shipping circles and has led the Chamber of Shipping of the United Kingdom to designate it as a "grave interference with normal commercial practice" and a "most flagrant example of flag discrimination."

By the terms of the agreement as published, the new company obtains the right to transport all Saudi Arabia oil that is not shipped in the tankers of the four American companies who are partners in Aramco (The Arabian-American Oil Co.). Furthermore, Aramco, which has been carrying 40 to 50 percent of the oil shipped from Saudi Arabia in its own tankers, apparently will be precluded from enlarging the fleet it was operating on December 31 and will not be permitted to replace these vessels as they go out of service.

Of Aramco's production of crude oil of 41,543,736 tons, some 21,000,000 tons has been refined partly in the Aramco refinery at Ras Tanura, partly at the refinery of the Bahrain Oil Co. and the remainder sold to other interests.

This remainder of about 10 million tons has been carried by vessels registered under the British, Danish, Norwegian, Italian and Liberian flags, and it appears that in the future this agreement will preclude the carrying of Saudi Arabia crude by these vessels. Mr. Onassis, described as a "minority shareholder" is to make available 25-30 modern tankers with a total 500,000 dwt for carriage of the oil not shipped in Aramco vessels. It is understood that the agreement also provides for the establishment of a maritime school to train Arab cadets who will be given priority for posts on the company's ships. As part of the program, Mr. Onassis will establish dry dock, workshop and salvage facilities.

Mr. Onassis, who has just launched a 47,000-ton supertanker named the King Ibn Saud I from a German shipyard, insists that his deal is not intended to set up a monopoly, but to supplement existing transportation facilities.

Netherlands New Guinea Pipe Line

The Nederlandsche Nieuw Guinee Petroleum Maatschappij which is owned by N. V. de Batafsche Petroleum Maatschappij (Royal Dutch/Shell group) 40 percent, Standard-Vacuum Oil Co. 40 percent and Far Pacific Investments Inc. 20 percent, has completed the building of a pipe line in Netherlands New Guinea, to provide an export outlet for crude oil from its jungle-surrounded fields at Wasian and Mogoi to a marine terminal on the river Maturi, 50 miles away.

The project involved the laying of two six-inch diameter lines to connect each field to a junction at Tembuni, where two 3,000-ton tanks and a pump house were erected. From Tembuni an eight-inch diameter line, 37 miles long, was laid to Muturi Hill, where two 22,000-ton storage tanks were built. For the final 10 miles from Muturi Hill to the terminal, a 24-inch line was laid for gravity loading. The last section was over a coastal swamp, and the line had to be carried on a specially constructed trestle. The two fields are now producing at a combined rate of 1,300 tons per day. Materials for the project were manufactured in Holland, shipped to East Vogelkop and assembled there.

AIOC Refining Capacity Increased

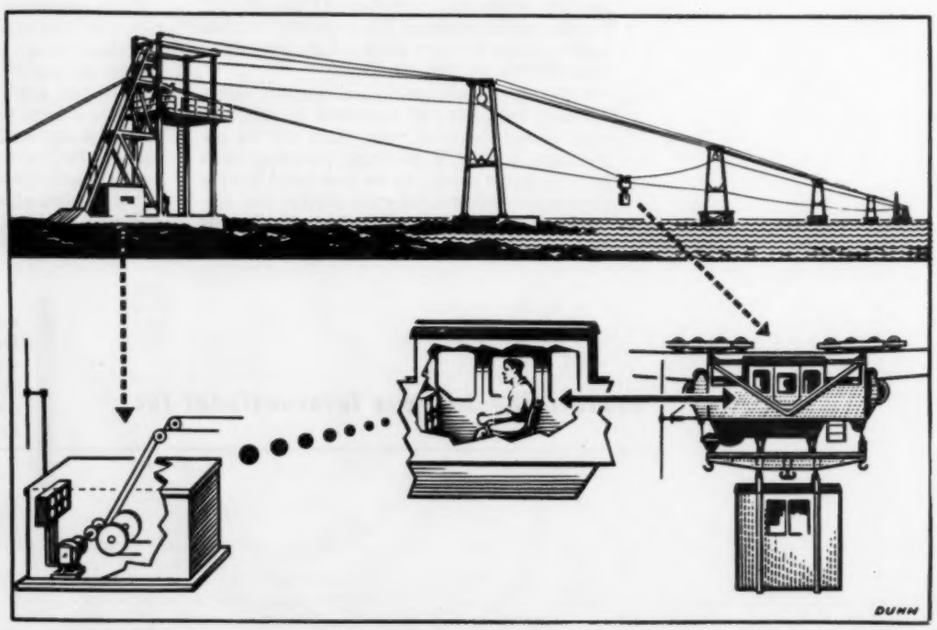
With the recent commissioning of a new combined atmospheric and vacuum distillation unit at its BP Hamburg refinery, Anglo-Iranian Oil Company's refining capacity in Germany has been raised to 28,000 barrels a day. Capacity at Hamburg is now 24,800 barrels a day compared with 14,000 a year ago, while the company's nearby Schindler refinery has a capacity of 4,000 barrels daily.

Oil Search Under South China Sea

Now under construction in the South China Sea, about a mile off the coast of British Borneo, are two new "artificial islands," steel structures designed for use as drilling platforms in the search for submarine oil. They will supplement the work of an existing platform from which wells have been drilled during the past year. Erected at a cost of some £200,000 for each complete platform and ropeway, these islands are to be used as bases from which it is hoped to find a submarine extension of Shell's Seria field, one of the largest in the British Commonwealth and now producing five million tons of crude oil annually.

The three platforms will be about 3½ miles distant from each other and from each can be drilled four separate wells, one vertical and the other three deviated. One special problem encountered was that of providing access to the platform during the long spells of stormy weather encountered in the South China Sea. The heavy swell experienced in this region for most of the year prevents vessels from coming alongside a platform. A solution was found in the construction of an aerial ropeway linking the platform with the shore.

The aerial ropeway in operation on the existing platform embodies a car, travelling on dual track ropes, which incorporates the driving mechanism in the car itself; this moves it forward and backward along the track ropes by means of fixed haulage ropes. The driving mechanism will be onshore and it will move the haulage ropes themselves which in turn are reeved through the driver's cab, thus moving it at varying speeds in either direction. The driver in the car will operate both the driving mechanism and special lifting winches for carrying equipment by remote radio control. A car for carrying personnel will be suspended from the driver's cab.



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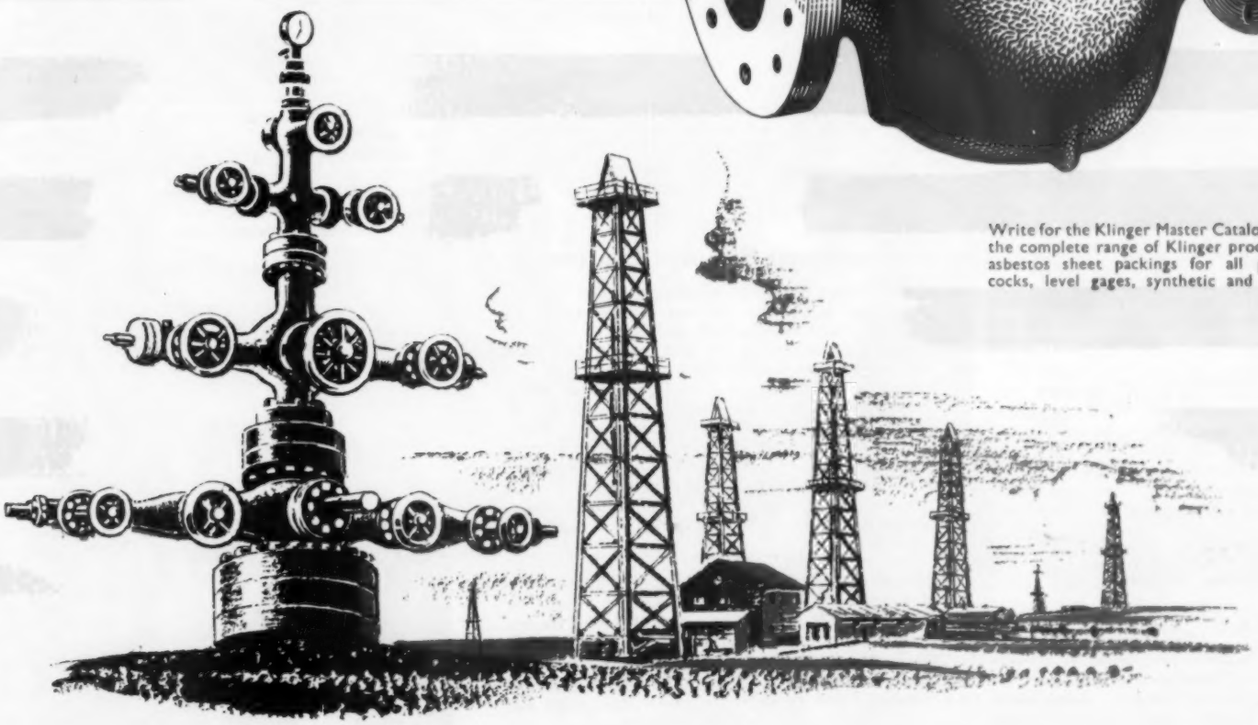

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One of four Heliston propellers designed for Furness Shipbuilding Co. for use on large tankers. This special Novoston alloy propeller has a weight of 23 tons and was designed to work at 105 rpm and 12,500 hp for a speed of 15½ knots.

New Alloy Adds Strength to Propellers

In previous articles on world tanker conditions, the problem presented by the increased size and weight of propellers required for very large vessels has been discussed. Recent developments in the metallurgy of propeller material, however, seem to point out that this problem has to a large extent been overcome through the production of a new alloy which has been extensively tried out in actual service with satisfactory results.

This new alloy is the result of several years of research in the laboratories of J. Stone & Co. (Charlton) Ltd. of England, well known specialists in propeller design, who are holders of patents on it in all maritime countries. It is designated as "Novoston" and is a copper base alloy in which the major alloying constituents are manganese, aluminum and nickel.

Its mechanical properties, compared with Stone's propeller bronze, are shown in the following table and refer to separately-cast test bars in all cases.

PROPERTY	NOVOSTON	STONE'S PROPELLER BRONZE
Proof stress (0.15%)	19 tons/sq. in. average	16 tons/sq. in. average
Ultimate tensile strength	41 tons/sq. in. average	32 tons/sq. in. average
Elongation (2" gauge length)	22% average	20% average
Fatigue stress (20×10^6 reversals in salt spray)	11 tons/sq. in. average	6.5 tons/sq. in. average
Specific gravity	7.5	8.3

The presence of a large proportion of manganese in the alloy differentiates Novoston from the usual nickel-aluminum bronzes. Advantages claimed for it are better foundry characteristics and a higher proof stress. Owing to higher ultimate and fatigue strength, the blade scantlings of propellers can be reduced while maintaining safety factors. Together with its lower specific gravity, this makes possible a considerable reduction in weight. The alloy in ingot form can be readily used for repairs by the method of "burning on." It can be readily welded, and in spite of its toughness, has good ductility and can be subjected to a fair amount of straightening. Although higher in cost per ton than propeller bronze, owing to its properties the ultimate increased cost per propeller is not great.

British Equipment Sales

The Council of British Manufacturers of Petroleum Equipment has issued the following statement showing the value of orders for materials and equipment placed in the United Kingdom by oil companies during the first quarter of 1954 in pounds sterling:

	£
Geophysical and other exploratory equipment	1,500
Specialized equipment for oil drilling & production including oil casing & tubing	1,352,000
Specialized equipment for oil refineries (not including pumps & valves)	502,400
Drum and can-making, filling & cleaning equipment, curbside pumps & other oil metering & dispensing equipment	136,200
Railcars, road tankers, aircraft & refuellers	49,700
Drums, drumsheets and tinplate	2,351,100
Tankage (including tank fittings)	698,200
Tubulars, pipe fittings & valves (ferrous & non-ferrous)	2,045,900
Pumps (excluding slush, oilwell & curbside)	393,300
Boilers, boiler house plant & accessories	223,100
Electrical equipment, motors, generators and transformers	749,100
Instruments, meters & gauges	302,200
Prime movers and compressors	526,000
Machine & hand tools, welding & miscellaneous machinery & stores	1,339,400
Ferrous and non-ferrous plates, sections, sheets & bars	471,600
Automotive equipment, all types	1,142,200
Laboratory equipment & chemicals including hospital & medical supplies	157,500
Bulk chemicals, catalysts, barites	6,376,000*
Cement & other building materials & hardware, including timber	656,800
Commissary, general requisites for office, warehouse, household, club and sports	1,398,100
	£20,872,300

*This figure is affected by bulk contracts placed for overseas on an annual basis; the normal quarterly figure is about £2 million. The normal total for period I, 1954, may therefore be reckoned as £16-17 million.

International Pollution Conference

Thirty-two countries were represented by delegates and ten others by observers at an international conference on oil pollution of the seas held in London during the first fortnight of May. The conference decided that the best means of ending such pollution was through an international convention and approved a covenant of 21 articles dealing with specifications of oil, types of ships, ballast, security and discharge regulations, the keeping of an oil record book, contraventions and acceptance of the convention, as well as containing a list of prohibited zones within which no oily discharge from a ship may take place.

The convention is to go into effect 12 months after it has been accepted by ten countries, five of which must have more than 500,000 gross tons of tankers. It already has been approved by ten countries, four of which, namely Italy, Norway, Sweden and the United Kingdom, have tonnages exceeding 500,000, so that full approval of the proposal seems certain.

Petroleum Based Detergents

One third of all soaps and detergents used in the United Kingdom are now synthetic products, obtained very largely from petroleum derivatives. According to unofficial estimates, these accounted for 170,000 tons out of a total of rather more than 500,000 tons of soaps and detergents consumed in Britain last year. This shows a remarkable increase in the use of synthetic products even as compared with 1952, when they accounted for rather less than a quarter of the total.

Road Bitumen Associations

A Road Bitumen Association has recently been formed consisting of the major United Kingdom bitumen producers and industrial groups concerned with the uses of bitumen and of materials allied therewith in road construction and maintenance. The principal objects are to promote research and other scientific work, and to afford facilities for the communication and interchange of views and information in connection with the bitumen trade or industry and other trades or industries allied therewith or accessory thereto.

Personnel

W. W. Harrison, who has been staff manager for Shell-Mex & B. P. Ltd. since 1948, has retired after 42 years' service with the company. He is being succeeded by H. R. Brewster, who has been with the company for 37 years and has been deputy staff manager since October 1953. As a member of the Territorial Army, Mr. Harrison was taken prisoner in 1942 and was freed by the Ninth United States Army in 1945, being demobilized with the rank of Major.

D. L. Pollock has been elected to the board of Vickers Ltd. He is a director of S. Pearson & Son Ltd., Legal and General Assurance Co. Ltd., Westminster Bank and other companies.

K. A. Ballard has been appointed to represent Samuel Osborn & Co. of Sheffield in the sale of steel castings with headquarters in London.

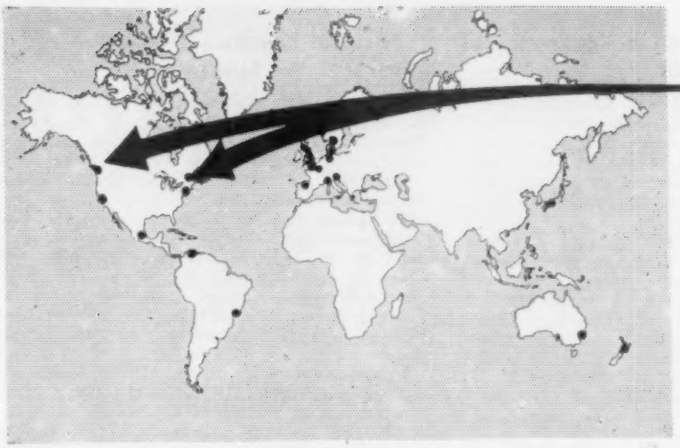
Gordon Reach and Montague Holbein of D. & C. and Wm. Press Ltd. have concluded purchase of the long-established Canadian firm of Ross-Meagher Ltd., civil engineers and contractors. The company will exploit the building of gas lines and other techniques in which the purchasers specialize. Recently D. & C. and Wm. Press, in association with the Morrison-Knudson Corp., obtained the contract for building the 350-mile Sui gas line in Pakistan which is now in course of construction. The company has been active in construction work in Iraq, Kuwait and Bahrain and was general contractor for the $56 million extension of Anglo-Iranian's Llandarcy refinery. Chairman of the company is Sir Brograve Campbell Beauchamp, Bart.

A new company has been formed to represent the international interests of WKM company of Houston under the title of WKM Valve Co. (Britain) Ltd. R. Adams, formerly an executive of Kellogg International Corporation, has been appointed technical director and general sales manager.

Alexander Waterston, a director of Esso Petroleum Co. Ltd. since 1938, has retired after completing 40 years' service with the company. A Scotsman by birth, Mr. Waterston began his career in the company's Glasgow office in 1914. After service with the Royal Artillery until 1919, he rejoined the company, and through successive promotions became branch manager in Glasgow. In 1934 he was appointed general sales manager in London and was made a director in 1938.

Alexander Waterston

International Paints *in Canada*



At Montreal and Vancouver, associated "International" factories are producing paints for a variety of purposes. Their on-the-spot technical experience of paints for Canadian requirements is no small contribution to the wealth of knowledge accumulated by the world wide group of International factories.

"International" have associated Companies in 15 other countries and close co-operation ensures the ability to supply the right paint for anything, anywhere. "International" products include METAL PRIMERS and ALUMINUM PAINT for storage tanks; DRUM PAINTS, and ENAMELS for general purposes.

International Paints Ltd.

Head Office: GROSVENOR GARDENS HOUSE, LONDON, S.W.1

TELEPHONE: TATE GALLERY 7070 (15 LINES)

TELEGRAMS, INLAND: CORROFOIL, SOWEST, LONDON. OVERSEAS: CORROFOIL, LONDON

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MAIN FACTORY IN U.K. FELLING-ON-TYNE

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CANADA	MONTREAL	ITALY	TRIESTE	SWEDEN	GOTHENBURG
CANADA	VANCOUVER	JAPAN	KOBE	U.S.A.	NEW YORK
DENMARK	COPENHAGEN	MEXICO	MEXICO CITY	U.S.A.	SAN FRANCISCO
FRANCE	LE HAVRE	NORWAY	BERGEN	VENEZUELA	MARACAIBO

INTERNATIONAL NEWS AND NOTES

Iranian Oil Talks Resumed

Negotiations between officials of the Iranian government and representatives of the international oil company consortium which has offered to handle the production and marketing of Iran's oil were resumed during the third week of June following the return to Teheran of the special committee that has represented the oil group in previous talks. The committee consists of Orville Harden, Standard Oil Co., (N.J.); J. Loudon, Royal Dutch/Shell Group; and E. H. Snow, Anglo-Iranian Oil Co. Ltd.

Earlier discussions were suspended several weeks ago as a result of disagreement over the terms under which operations were to be conducted. While recognizing Iran's ownership of the country's oil resources, the oil companies insisted upon a share in technical management that would enable them to assure a dependable supply of oil to fulfill their obligations to the members of their group. The problem was how to make certain of this without impinging on the full control demanded by Iran.

Meetings of representatives of all members of the consortium in London during the past month have led to a revised proposal designed to reconcile earlier differences, and this is the subject of the current discussions.

Herbert Hoover, Jr., special assistant to the Secretary of State of the United States, who has acted as advisor in earlier negotiations, also returned from Washington to Teheran in the latter part of June.

Werkspoor-Stork Merger

Two of the largest manufacturing firms in The Netherlands have joined forces in order to cover more effectively the whole field of engineering and construction. The merger will combine the facilities of N.V. Werkspoor, Amsterdam, founded in 1827, and Gebr. Stork & Co. N.V., Hengelo, established in 1868, both of which have a world-wide reputation.

A new corporation is being established with a capital of 32 million florins ($7,500,000) which will become the holding company for shares of the two organizations and will have its headquarters at The Hague.

The products to be manufactured include steam engines, turbines, boilers, machinery for tropical plantations, installations for the chemical and refrigerating engineering industries and for the petroleum industry, ship's machinery, pumps and drainage equipment, locomotives and rolling stock for railways, bridges and other steel structures, cranes, elevators, and other specialized equipment.

Alaska Wildcat Dry

Phillips Petroleum Co. and Kerr-McGee Oil Industries, Inc. have completed the drilling of the first of a series of test wells to evaluate the block of approximately one million acres in the Katalla-Yakataga Area of Alaska. This well, Sullivan Strat No. 1, located four miles north of Icy Cape and 26 miles east of Cape Yakataga, was drilled to a total depth of 4,837 feet. No significant showings of oil or gas were encountered. On completion of access road, the second well, Sullivan No. 1, will be drilled at a location five miles west and two miles north of the original test well.

Pacific Pumps Representative

A-Z Export, S.A., Maracaibo, Venezuela, has become the exclusive representative for Pacific Pumps Inc. in Venezuela and Colombia and for oil well pumps and parts in Venezuela.

Geologic Reports On Northern Alaska

Geologic reports and technical data relating to the exploration program in Naval Petroleum Reserve No. 4 and adjacent public lands in northern Alaska have been made available for public inspection through the cooperation of the Office of Naval Petroleum Reserves, Department of the Navy, and the Geological Survey.

The technical data include geologic reports, photogeology maps of a large part of northern Alaska, and reports on the Gubik gas field and the Umiat oil field. The geologic reports on the stratigraphy and structure of parts of NPR-4 and adjacent public lands cover a hitherto virtually unmapped area of approximately 50,000 square miles.

A list of material now available for public inspection can be obtained from the Director, Geological Survey, Washington 25, D. C.; Director of Naval Petroleum Reserves, Department of the Navy, Washington 25, D. C.; or Inspector, Naval Petroleum Reserve No. 4, 520 Illinois Street, Fairbanks, Alaska. Reports and data now available for inspection may be studied in the offices of the Geological Survey, Washington, D. C., Room 2542, Interior Building, and in the office of the Inspector, Naval Petroleum Reserve No. 4, Fairbanks, Alaska.

Exploration in England

A further step in D'Arcy Exploration Co.'s search for natural gas on behalf of the Gas Council is the drilling of Ashdown No. 1 well on a site near Crowborough Warren, Crowborough, Sussex, which commenced at the end of May. This district is considered, geologically, to be one of the most likely to contain gas, some natural seepages being known. The well is estimated to be completed to a depth of about 2,000 feet in three to four months.

A test well is to be drilled near Granby, Nottingham in the search for oil in England, its possible depth being estimated at about 2,500 feet.

To Build Egyptian Pipe Line

It is announced that the contract for construction of a pipe line from Suez to Cairo has been awarded to the Dalmine group of Milan, Italy, by the Egyptian government. The line is intended for the movement of fuel oil from the Suez refinery to the capital. It will be 81 miles in length and the contract cost is stated as $7,200,000. Specifications call for pipe of 12 inch diameter or larger equipped with a viscosity breaker on account of the heavy character of the oil to be transported.

Pacific Northwest Gas Project Approved

On June 18 the Federal Power Commission in Washington gave its approval to the Pacific Northwest Pipeline Corporation's proposal to construct a pipeline system for the movement of natural gas from the San Juan Basin in New Mexico and Colorado and from other fields along its proposed route to the northwestern states of Washington and Oregon. At the same time it rejected the plan of Westcoast Transmission Company for supplying gas to the same area from western Alberta and British Columbia. It also rejected the proposal for other shorter lines planned to move Canadian gas into the United States.

By the commission's decision, Pacific Northwest is directed to begin construction of its line, which is estimated to involve an investment of $160,000,000 not later than January 1 next and to complete it within two years.

Esso Refinery Opening in Germany

Formal dedication of the new crude oil charging and catalytic cracking units of Esso A.G. (subsidiary of Standard Oil Co., N. J.) took place at Hamburg-Harburg, Germany, on April 29. The new installations raise the charging capacity of the plant to 35,000 barrels daily and make it one of the most complete refineries in central Europe. Products of the enlarged refinery will be motor gasoline, diesel oil, jet fuel, industrial lubricants, bitumen and LPG.

In an address delivered at the opening ceremony, Stewart P. Coleman, a director of the parent company, hailed the new construction as a noteworthy example of international cooperation.

New Continental Store

The Continental Supply Company Ltd. has opened a new store in Regina to serve southern Saskatchewan and southwestern Manitoba. J. M. McNeill is manager, J. B. Eyndhoven assistant. The store is operating under the supervision of E. M. Fetzer, managing director of Canadian operations, Calgary, Alberta.

Kaiser Co. Appoints Cornforth

Robert M. Cornforth has been appointed manager of refinery sales for the engineering division of the Henry J. Kaiser Co. He was formerly with the Houdry Corporation as vice president in charge of sales and more recently was vice president of Wm. Barnes Co. of Los Angeles and Toronto, Canada.

Tellepson Construction Co. of Houston recently shipped ten 30-inch welding elbows by air from the Ladish Co. factory at Milwaukee, Wisc., to Creole Petroleum Corp. in Venezuela. Slick Airways carried the urgently needed fittings in a DC-6.

Oil from the Silent World

UNDER THE WARM WATERS OF THE PERSIAN GULF a team of 'aqua-lung' divers led by Commandant Cousteau—famous underwater explorer—is helping Anglo-Iranian's search for oil.

These men, swimming like fish over the seabed, can explore its geology more closely than has ever before been possible.

Soon, oil from under the sea may be added to the 400,000 barrels per day which flow through Anglo-Iranian's refineries in seven countries. Meanwhile the search for more oil continues from Papua to Nigeria as Anglo-Iranian products spread heat, light and power across the world.

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF

Anglo-Iranian Oil Company
LIMITED

OIL COMPANY STAFF CHANGES

R. W. French

R. S. Stewart

C. E. Spahr

H. S. Moller, Jr.

RICHARD W. FRENCH, general manager of Standard Oil Co. of Ohio's production department since February 1953, was elected vice president for production. He will continue in charge of all crude oil and natural gas exploration and production activities of the company and its subsidiaries, with headquarters at Oklahoma City, Okla. Mr. French joined Sohio in 1947 as chief engineer in the production department.

Richard S. Stewart, assistant to the president of Sohio since 1949, was re-appointed and elected a vice president. He will continue to assist the president and the heads of the production, crude oil purchasing, finance and accounting departments, as well as the crude oil division of the transportation department and the office of the chairman of the board. Mr. Stewart joined Sohio in 1938, after six years of experience with The Texas Co. following his graduation in 1932 from Cornell University.

Charles E. Spahr, assistant to the president, was re-appointed and re-elected a vice president, but was relieved of the responsibilities as head of the transportation department in order to devote his entire time to duties as assistant to the president. Mr. Spahr has been with Sohio since 1939 except for a period of war service in India-Burma.

Joseph D. Harnett, assistant manager of the transportation department since 1942, was appointed manager of the department and becomes a member of the president's staff, with headquarters at St. Louis, Missouri. Mr. Harnett joined Sohio in 1941.

Hans S. Moller, Jr., assistant secretary of the company since May 1951, was elected secretary. Mr. Moller will continue to report to the financial vice president, A. E. Wolf, who previously had also been secretary. Mr. Moller joined Sohio in 1947.

Sidney D. Williams, manager of crude oil and natural gas accounting activities for the company and its subsidiaries, with headquarters at Oklahoma City, Okla., was appointed assistant controller.

Re-elected officers include: A. A. Stambaugh, chairman of the board; Clyde T. Foster, president; Samuel H. Elliott, Elliott B. McConnell, Richard E. Sauer, A. E. Wolf, Charles E. Spahr, J. F. Wilson, vice presidents; Ralph A. Martin, controller; and E. W. Allgower, treasurer.

M. S. KENDRICK has been appointed to the newly-created position of coordinator of offshore operations for Continental Oil Company's southern region. Conoco is part owner of 27 wells off the shores of Louisiana which are netting the company approximately 46,000 barrels monthly. The company discovered the West Delta Oil field, south of New Orleans, in 1953 and currently is drilling two exploratory wells in the Louisiana tidelands. Mr. Kendrick joined Creole Petroleum Co. in Venezuela in 1926, and was associated with that firm in South America until recently. He was a member of Creole's management committee.

R. D. MC GRANAHAN has been elected a vice president of Gulf Oil Corporation and C. W. Hurley, Jr., has been made director of co-ordination.

Mr. McGranahan will be responsible for the direction and co-ordination of all forms of transportation. He joined Gulf in 1948 as a member of the executive staff and has been concerned with transportation and storage. He is an alumnus of Allegheny College and the Harvard Graduate School of Business Administration. He was previously connected with Westinghouse Electric and Manufacturing Co. and National Refining Co.

Mr. Hurley will be a member of the executive staff and will be responsible for the co-ordination of all departments involved in meeting domestic and foreign sales requirements. Following his graduation from Texas A. & M. in 1922, Mr. Hurley joined Gulf as assistant chemical engineer at Port Arthur. Seven years later he became chief chemist and continued in this position until his transfer to the Pittsburgh office in 1934 as assistant to the general manager of manufacturing. In 1939 he was transferred to the executive department, where he was concerned with crude oil supply and the manufacture and distribution of products.

PAUL H. LE FEVRE has been elected an assistant treasurer of Socony-Vacuum Oil Co. He joined the company in 1928 as a member of the foreign accounting staff. Later he served in the controller's department and in positions with Socony-Vacuum operations in South America. In 1952 he was named treasurer and controller of Socony-Vacuum Overseas Supply Co. He is an alumnus of New York University and resides at Hohokus, New Jersey.

M. S. Kendrick

JOHN STEIN has been promoted to project engineer of the Northwestern district of the British-American Oil Producing Co., and Wayne Rogers to district engineer of the Central district in Oklahoma City, succeeding Gordon J. Buckle who recently was made district superintendent of the Southern district at Houston.

Mr. Stein joined British American in 1949 as a roustabout and engineer trainee in the Southern and Central districts. He was promoted to junior engineer in 1950 and for a two-year period served alternately in the Northwestern district and the head office in Tulsa. In 1952 he was promoted to petroleum engineer after being transferred to Steamboat Butte, the position he held at the time of his new assignment.

Mr. Rogers joined B-A in 1949 as an engineer trainee in the Southern district and later was promoted to junior petroleum engineer in the Northwestern district, stationed at Steamboat Butte. He served B-A's former head office in Tulsa in this same capacity. He was promoted to petroleum engineer and came to Dallas in 1952, where he has remained until his new assignment.

I. L. COFFMAN, chief engineer of Phillips Petroleum Company's refining department, has been transferred to McGregor, Texas, as manager of engineering at Air Force Plant No. 66, operated by the rocket fuels division of the company's research and development department. L. G. Molique, assistant superintendent of Phillips' Kansas City, Kansas, refinery, will replace Mr. Coffman with headquarters at Bartlesville, Okla.

Phillips has been contractor-operator since 1951 of the Air Force plant which is engaged in large-scale development leading to manufacture of solid fuels for rockets of the jet-assist take-off type. Over 500 people are employed at the McGregor installation, where versatile rocket propellants, using ingredients produced from petroleum raw materials, have undergone successful full-scale firings.

JOE GILL, landman, has been promoted to assistant division land superintendent of Continental Oil Company's exploration division with headquarters in Oklahoma City. He succeeds W. B. Beall, who was recently promoted to division land superintendent at Wichita. Ben W. Smith, party chief, has been promoted to geophysical supervisor, Oklahoma City, succeeding Graham Fenner, who was recently transferred to Ardmore as geophysical supervisor.

RICHARD P. SHUCK has been named as supervisor of oil movement for The Ohio Oil Co. In this capacity, he will co-ordinate the movement of crude oil and petroleum products through the company's pipe line transportation system.

First employed as a messenger in the general office at Findlay, Ohio in 1930, Mr. Shuck has served in the company's marketing and pipe line departments continuously except for three years spent in the Navy.

R. P. Shuck

OIL
MUST BE DISCOVERED

SSL Seismic Operations in Trinidad

TRINIDAD, the most southerly island of the West Indies, is a very attractive country. It is one of the largest oil producers in the British Commonwealth. The smallness of the island and its good facilities for comfortable living make it a most welcome assignment for geophysicists.

Geologically, TRINIDAD is an extremely complex area. The geophysicist, in search of petroleum, is confronted with many difficult and unusual problems of interpretation. Seismic field crews must be experienced in, and equipped to operate under conditions ranging from arduous jungle and swamp to easy progression along good roads.

In fulfilling its TRINIDAD seismic assignments, Seismograph Service Limited draws on the 23 years of world-wide experience accumulated by itself and its associate companies—Seismograph Service Corporation, U.S.A., Seismograph Service Corporation of Venezuela, of Mexico, of Colombia, of Canada, and Compagnie Francaise de Prospection Sismique. Though the operational activities of these companies are restricted to different areas of the world, there is no limitation amongst them in the pooling of ideas, techniques and know how.

SSL

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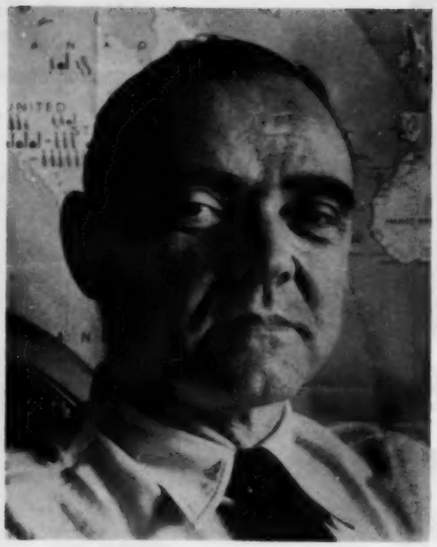
"HOLWOOD," KESTON, KENT, ENGLAND

SUBSIDIARY OF SEISMOGRAPH SERVICE CORPORATION, TULSA, OKLAHOMA, U. S. A.

THOMAS ARTHUR, drilling superintendent of the Assam Oil Co., Ltd., Digboi, India, retired in April after 28 years' service with the company in the East. He began his oil industry career as an apprentice driller at Badarpur, in the Surma Valley of Assam. Last year, as driller-in-charge of the AOC test at Nahorkatiya, on the edge of the Brahmaputra Valley alluvial plain, he drilled in the deep well which first discovered oil in this area. Mr. Arthur, a native of Hamilton, Scotland, plans to settle in Brisbane, Australia.

JAN G. SCHAAFSMA has been advanced to the post of assistant manager of General Petroleum Corporation's laboratories department. He joined the company in 1934 upon receiving his master's degree from the California Institute of Technology and has been engaged in laboratory work since that time. He was first employed as a junior inspector and has been assistant to the manager since 1947.

J. G. Schaafsma



T. Arthur

H. F. TOMFOHRDE, JR. has been appointed secretary of the eastern division operating committee and assistant to the vice president and chairman of the eastern division operating committee of the Tide Water Associated Oil Co.

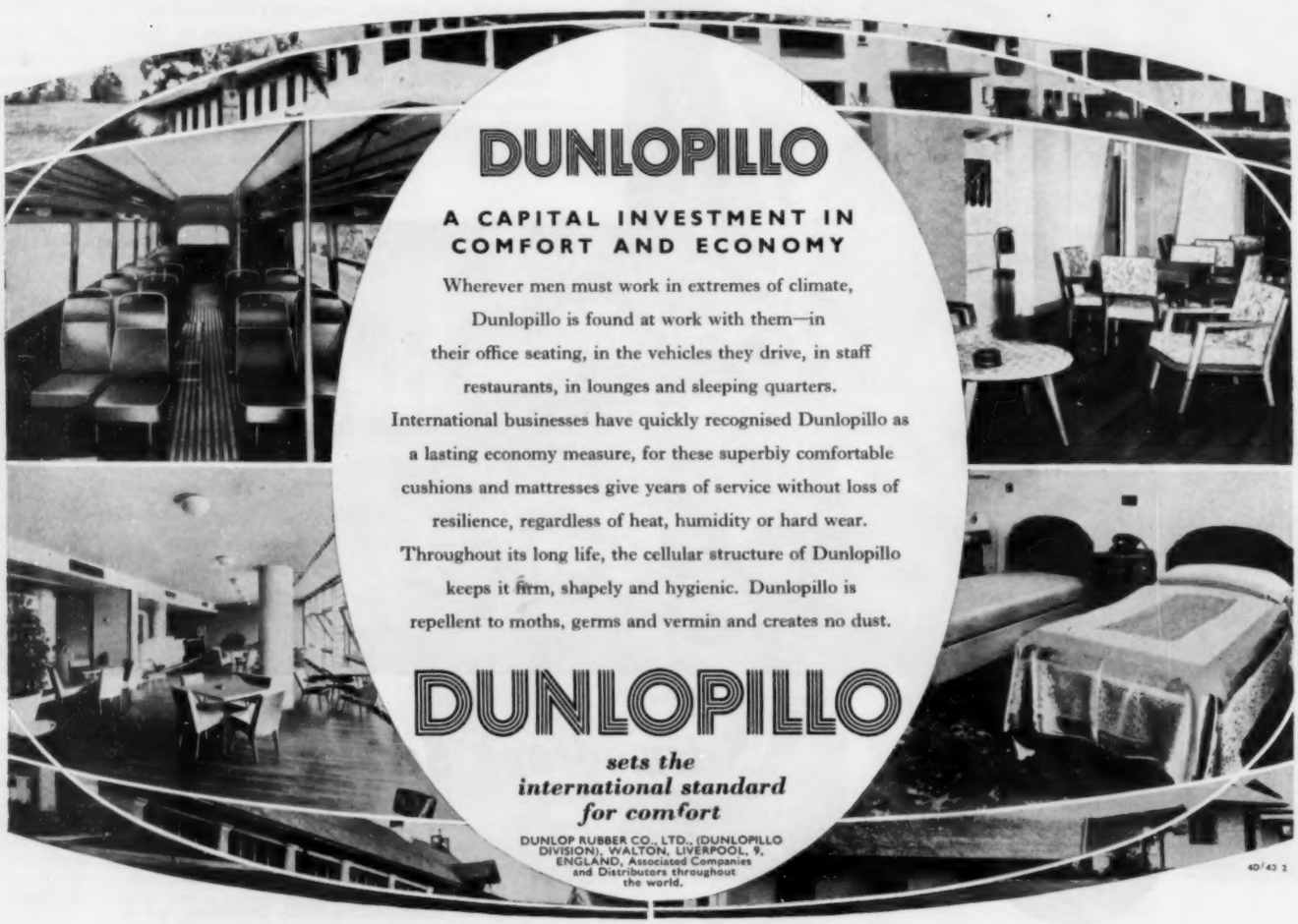
Mr. Tomfohrde joined the company in January 1929 as a development engineer at Tide Water Associated's Bayonne, N.J. refinery. He was transferred to the company's New York office in 1936 and was made technical assistant to the manufacturing department. He was named assistant to the vice president of the department in September 1950, the post he held until his most recent advancement.

W. B. BEALL, Oklahoma City, has been promoted to division land superintendent of Continental Oil Company's Wichita, Kan., exploration division.

Formerly assistant division land superintendent at Oklahoma City, he succeeds Hanes M. Dawson, who recently was transferred to Ardmore, Okla., as division land superintendent of Conoco's newly formed Ardmore exploration division.

EVERETT J. GRIFFIN has been appointed assistant to the vice president in charge of marketing for the Shell Oil Co. He will assist in the coordination and administration of the company's marketing activities from coast to coast. Mr. Griffin was formerly manager of Shell's Cleveland marketing division and is being succeeded there by John W. Hall, previously marketing operations manager in the New York headquarters.

H. F. Tomfohrde, Jr.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40/43 2

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OSBORN

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5. High resistance to wear.
6. "Titanic" tube expanders can be made to suit all types of fittings.

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In all stages of production constant inspection is made to ensure a first class job, which will give the user maximum efficiency and long service.

When only the best will do specify:

OSBORN 'TITANIC' TUBE EXPANDERS FOR OIL REFINERY FITTINGS.

SAMUEL OSBORN & CO., LIMITED

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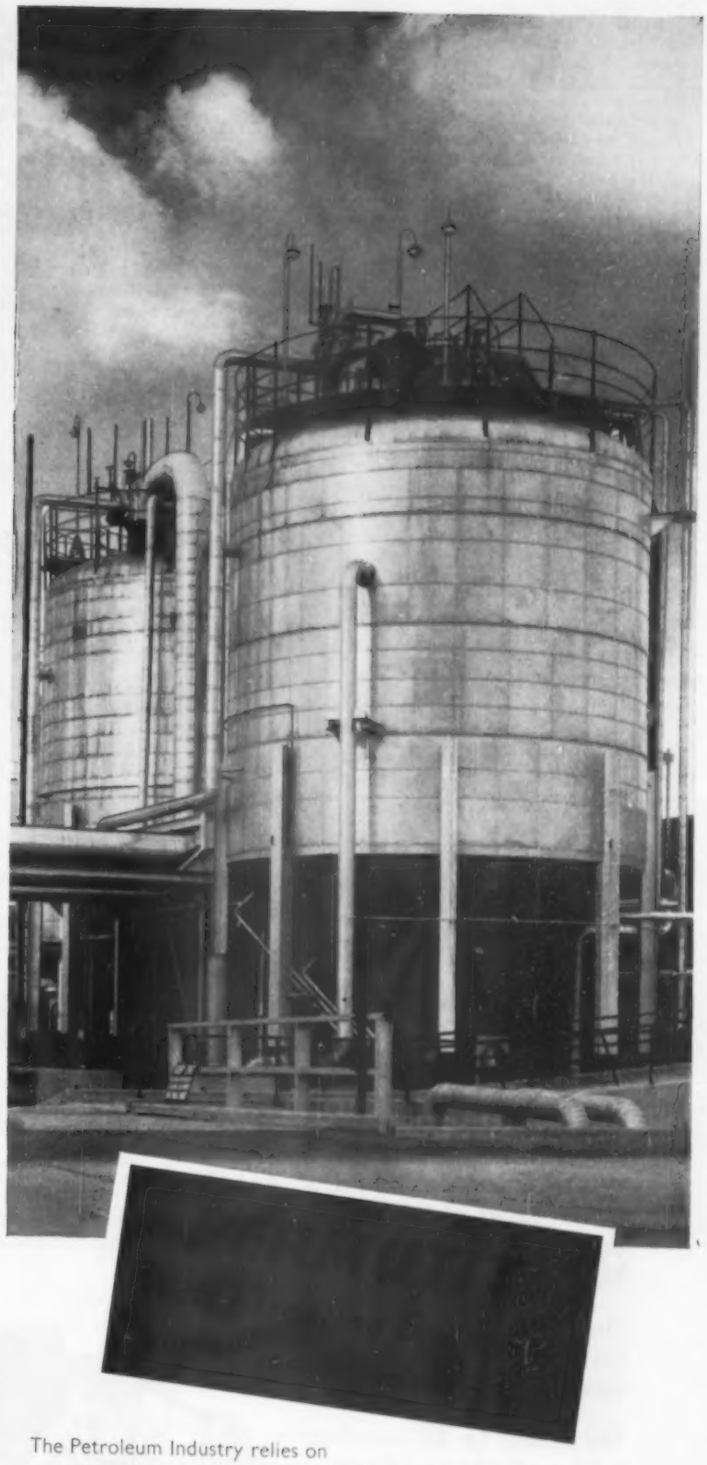

The Petroleum Industry relies on Permutit Plant to treat the many millions of gallons of water it requires for boiler feed. This photograph shows the Permutit installation at the Coryton Refinery of the Vacuum Oil Company Ltd., consisting of Hot Pressure Lime Softeners, followed by Hot Ion Exchange Softening and final De-aeration.

Permutit can solve every water treating problem for you too. We will gladly give you advice.

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ROBERT H. COLLEY, chairman of the board of Atlantic Refining Co., resigned his position on April 30 but retains his membership on the board. Mr. Colley, who had been active in the oil industry for 48 years, joined Atlantic in 1919 after completing his military service in World War I. In 1926 he was named assistant treasurer and in 1929 he became treasurer and a member of the board of directors. In May 1937 he was elected president of the company.

During his term as president, Mr. Colley guided Atlantic through the difficult war years and the company expansion program that followed. In May 1952, he was succeeded as president of the company by Henderson Supples Jr., and at that time was elected chairman of the board.

For many years he was a director and member of the executive committee of the American Petroleum Institute, and at its annual meeting in November 1953 was elected an honorary life director.

J. H. GALLOWAY, assistant superintendent of the West Texas division of Humble Oil & Refining Co. for the past four years, has been named assistant manager of the production department to assist in handling field operations. L. H. Byrd, production superintendent in Humble's California area, will succeed Mr. Galloway in the Midland post.

In his new assignment, Mr. Galloway will serve as one of three assistant managers in the Houston headquarters of Humble's production department. The other two are Bowman Thomas, in charge of engineering and staff work, and John O. Sue, in charge of natural gas operations.

Mr. Galloway joined Humble in 1930 and served as a petroleum engineer, district engineer, assistant district superintendent, and district superintendent in various parts of Texas before moving to Midland. During World War II he served with the Corps of Engineers in the European Theater of Operations.

M. E. Stone

MILLARD E. STONE, director of industrial relations for Sinclair Oil Corp. and subsidiaries, has been elected a vice president of the parent company. Mr. Stone came to Sinclair in November 1952. He served on the War Labor Board during World War II, and was chairman of the industry members of the Wage Stabilization Board in Washington during the postwar period.

C. E. BUCHNER has retired as executive manager of the Independent Petroleum Association of America because of failing health. He has been succeeded by I. C. Huff, Jr., assistant executive manager of the national oil trade association.

Mr. Buchner joined IPAA as executive manager in 1931. He has had an active part in building the association from a small group of independent oil men to a nationwide organization with membership in every oil producing area. He will be retained as a consultant.

LUCIEN F. CRAIG has been appointed Washington representative for the Gulf Oil Corp. and its subsidiaries. He will be a member of the company's executive department, reporting to vice president R. M. Bartlett.

Mr. Craig has been associated with Gulf for nearly 20 years. During World War II, he spent two years in Washington, where he was associated with the Petroleum Administration for War.

LAURANCE A. GLEASON has been appointed as assistant to the vice president in charge of manufacturing of Tide Water Associated Oil Company's eastern division.

Mr. Gleason joined the company in 1947 as a junior engineer in the process control department. He was promoted to technical assistant in the same department in November 1951, and the following month was named technical assistant to the general superintendent at the refinery, his most recent position.

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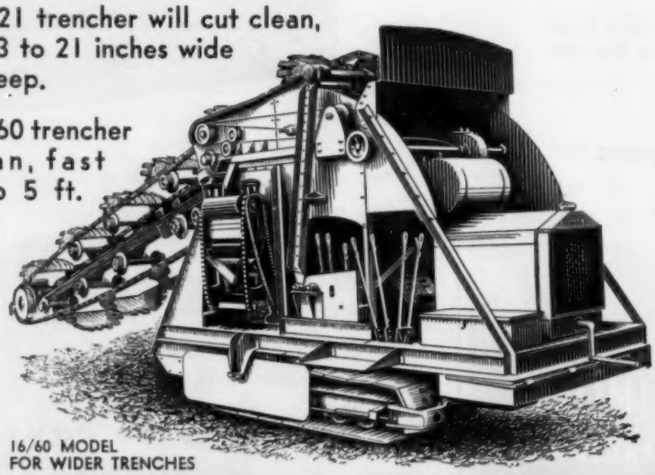

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Socony to Close Olean Plant

Because of past and prospective uneconomic operations of the plant, the Socony-Vacuum Oil Co. is taking preliminary steps to prepare for the eventual shutdown of its Olean refinery, one of the oldest in the United States, according to an announcement by George S. Dunham, director in charge of manufacturing for the company.

Efforts will be made to sell the properties to some industrial enterprise, Mr. Dunham said, so they can continue to provide jobs and contribute to the economic well-being of the community. He also pointed out that the approaching completion of the company's new refinery at Ferndale, Wash. would make new jobs available for Olean employees.

Socony-Vacuum's refinery, which began operations in 1876, occupies about 114 acres in the northwestern part of Olean, New York. The plant has been the training ground for many refinery operatives now occupying important positions in the United States and abroad.

W. R. Grace Acquires Davison Chemical

Stockholders of The Davison Chemical Corp. have approved merger of the company with W. R. Grace & Co. The company will operate henceforth as the Davison Chemical Co. division of W. R. Grace & Co., and headquarters of the division will be in Baltimore as heretofore. The directors and officers of Davison will continue in corresponding posts of the new division of Grace.

Heads Westinghouse Manufacturing

Donald C. Burnham has joined Westinghouse Electric Corp. as vice president in charge of manufacturing. He succeeds T. I. Phillips, who is retiring after 39 years of service.

Mr. Burnham formerly was with General Motors Corp., where he served as manufacturing manager and assistant chief engineer of the Oldsmobile division.

Turkey's Petroleum Law

(Continued from page 48)

siderable promise even though unexpectedly thick Miocene beds exist in the Adena basin.

"Elsewhere in Turkey there are areas worthy of significant attention: The Antalya basin, the Salt Sea basin of central Anatolia, the Lake Van area, the extensive sedimentary area along the Black Sea and the sedimentary basins of Thrace."

Mr. Batzell added:

"This legislation, opening up Turkey to development by private industry after 20 years, represents the first reversal of a trend toward nationalization of natural resources, especially petroleum, observable throughout the world in the past 30 years.

"Turkey is also aware that countries which have nationalized their oil industry have been significantly unsuccessful in finding and producing oil. Turkey knows that Russia, which in 1900 and 1901 was the world's leading oil producer, has but trebled her annual production in the past 50 years, while the United States has increased its annual production nearly 30 times.

"Turkey knows that nationalization in other countries of both hemispheres has failed to produce enough oil for their needs. She is acutely aware of the difficulties Iran has encountered in attempting to nationalize her oil industry.

"Turkey has examined carefully her own situation and has reached the conclusion that vigorous as she has been in seeking to find oil, a government operation cannot find enough petroleum quickly enough to meet the needs of a people aggressively interested in industrialization."

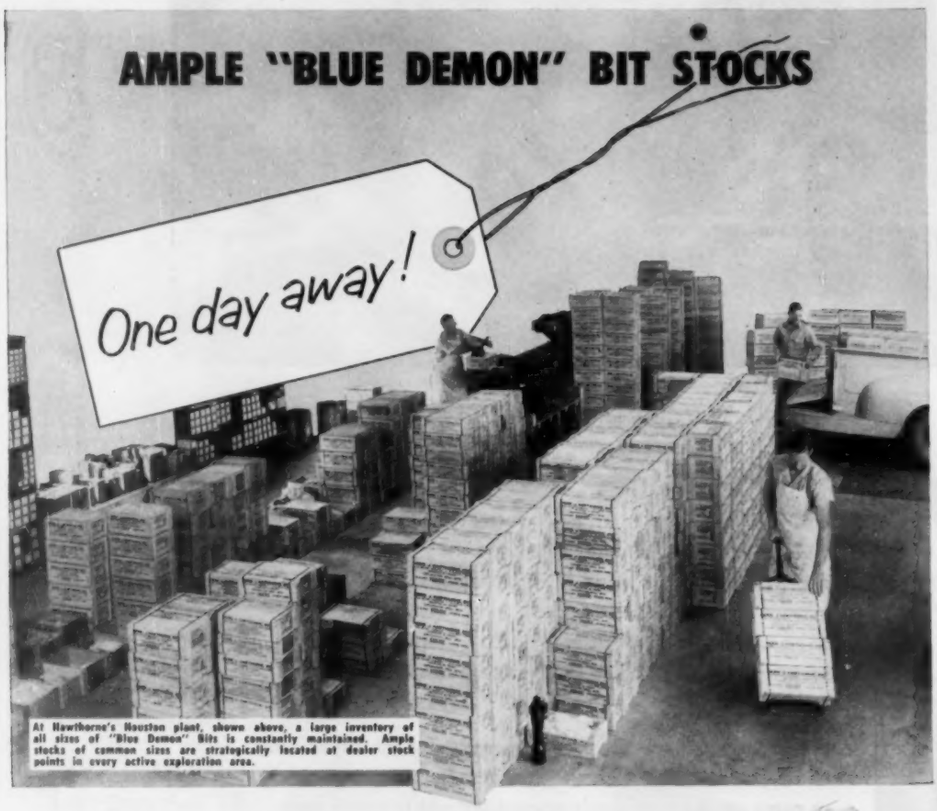
Texaco Appoints Industrial Relations Manager

C. B. Barrett, vice president in charge of sales for The Texas Company, has announced the appointment of R. E. Cox as manager of industrial relations for the company's domestic sales departments. Mr. Cox, who has served as assistant manager since the first of the year, succeeds George W. Schwert, retired after 43 years of service.

McCuaig Promoted by Worthington

M. M. Lawler, Worthington Corp. vice president, air conditioning and refrigeration, recently announced the appointment of Donald H. McCuaig as manager of application engineering for the entire Worthington air conditioning and refrigeration division. Mr. McCuaig joined Worthington in 1944 as application engineer of the air conditioning and refrigeration division, Holyoke, moving up to position of manager, central station equipment section, in 1952, which post he held until his present appointment. He is a member of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers.

D. H. McCuaig



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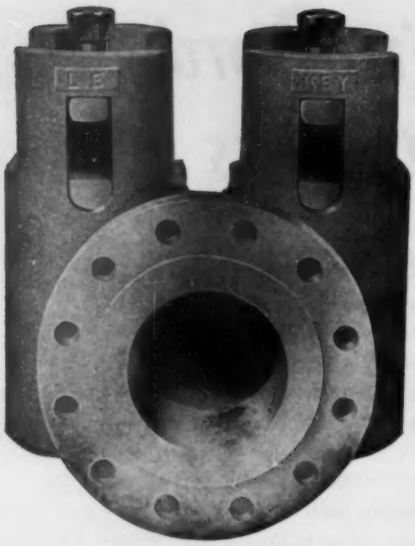

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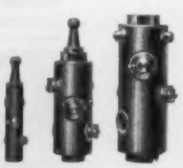

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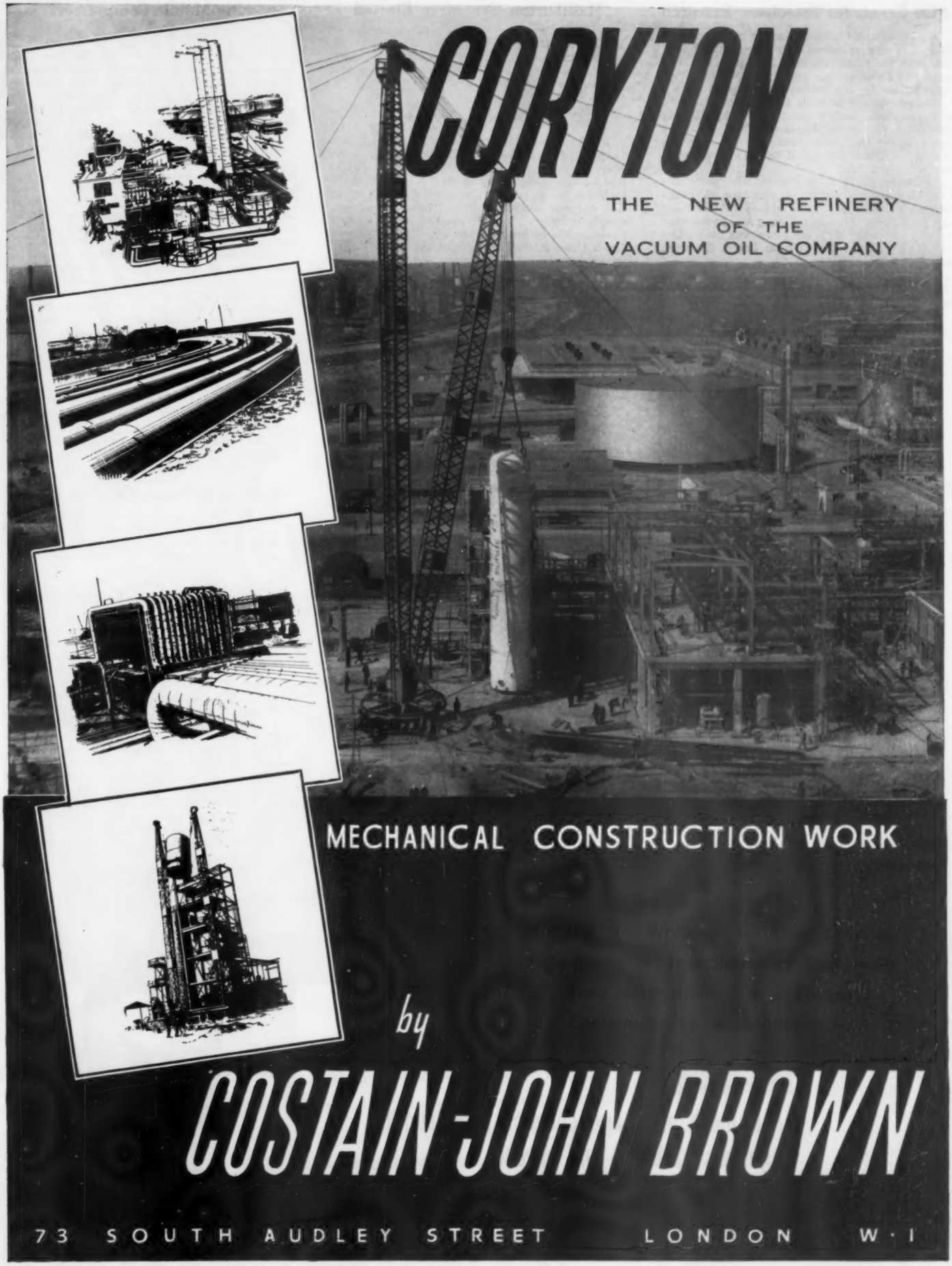
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ACS Grants for Petroleum Research

The American Chemical Society has announced that it is now prepared to make grants for research in the petroleum field from the Petroleum Research Fund set up some years ago for administration by the Society.

The grants will be made by the Society's board of directors to persons recommended by a newly appointed Petroleum Research Fund Advisory Board under the chairmanship of Dr. Cary R. Wagner of Utica, Ohio, well known consultant in the petroleum field.

For purposes of these grants, the "petroleum field" is considered to include any area of fundamental research which, as stated in the trust agreement creating the fund, may lead to research directly connected with the petroleum field. Under the policy laid down by the board, the work must be done in a non-profit institution, either in the United States or abroad, and all patents resulting from such work must be immediately dedicated to the public, royalty free.

Halliburton Treasurer Elected

G. D. McEnroe has been elected treasurer of Halliburton Oil Well Cementing Co., filling the vacancy created by the death of Hugh H. Leonard. He will be in charge of taxes, credit, traffic and treasury departments.

William S. Evans

W. S. Evans, 72, president of Lucey Export Corp., died at his home in Englewood, N. J., on May 30. At the time of his death Mr. Evans had been actively engaged in the oil equipment industry for 46 years. He joined J. F. Lucey at Los Angeles in 1908 in one of the first oil well supply companies to be organized in the United States. He helped prepare the Famous Lucey No. 8 Catalog, the first comprehensive listing of drilling equipment. Mr. Lucey was instrumental in introducing rotary drilling to the industry and served on the first A.P.I. commitee on the standardization of drilling equipment.

Big Mobile Compressors

(Continued from page 49)

step it down to 2,400 volts for the two 55 hp synchronous motors. Another transformer section in the center steps voltage down from 2,400 to 220/110 for lighting and operation of all auxiliaries. The center also includes two full voltage synchronous motor starters with oil circuit breakers, an auxiliary control panel and a lighting control panel. Each of the high voltage sections is protected by current limiting fuses which give each section an interrupting capacity of 150,000 kva.

The car stows electric cable to tie in to the power supply and for grounding purposes. Quick and easy means have been provided to make the box car a firm foundation for operation of the big compressors. First, the ends of the car are clamped to the rails with four clamps, and then built-in, screw-type jacks lift the car off the springs, making the installation rigid and solid.

Aside from their value in emergencies, the mobile units are expected to effect considerable economies where need for air is temporary. Clark expects the same factors to make big mobile compressor plants valuable to private industry. Construction companies, for example, can use the mobile units on dam projects and other big jobs, saving the time and expense of stationary compressor installation. Large industrial concerns with many plants can give all their production lines standby protection with mobile compressors.

New West Texas Gasoline Plant

Stanolind Oil & Gas Co. has begun construction of a 10 million cubic foot gasoline plant in the Midland Farms field in West Texas. Gasoline Plant Construction Corp. is the prime contractor.

Dwyer Becomes Consultant

Cornelius J. Dwyer, who has spent the past seven years in important posts connected with petroleum operations in Washington and Europe, has resigned from government service to establish an office in New York as petroleum consultant.

Mr. Dwyer was born in New Rochelle, New York, and graduated from Yale University in 1939. After a period of newspaper work he enlisted at the beginning of World War II as a glider pilot in the Army Air Force and emerged in 1946 with the rank of Captain.

Following the war, Mr. Dwyer entered the diplomatic service and spent three years as petroleum attache to the United States Embassy in London. He was deputy chief and chief of the petroleum branch of the foreign aid program for three and a half years while the agency was part of ECA, MSA and FOA. For the past six months he has been director of the industry divisions of the Foreign Operations Administration which includes petroleum and gas.

C. J. Dwyer

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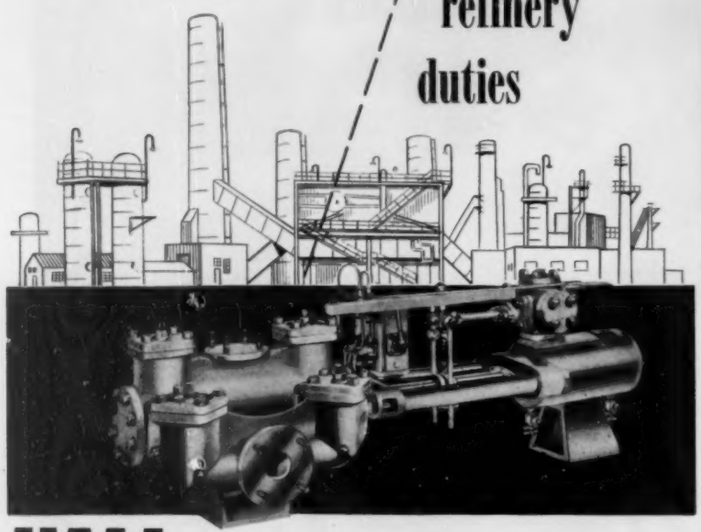

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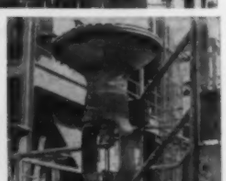

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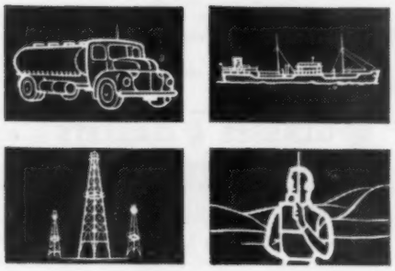

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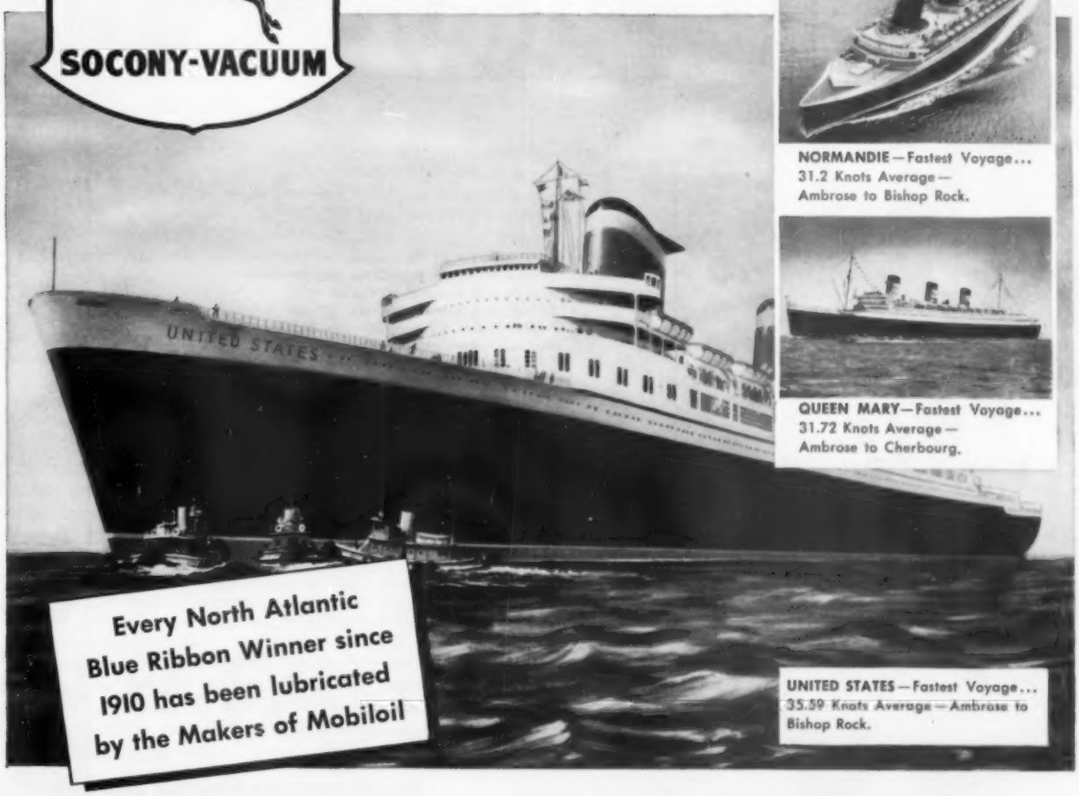
NORMANDIE—Fastest Voyage... 31.2 Knots Average—Ambrose to Bishop Rock.

QUEEN MARY—Fastest Voyage... 31.72 Knots Average—Ambrose to Cherbourg.



UNITED STATES—Fastest Voyage... 35.59 Knots Average—Ambrose to Bishop Rock.

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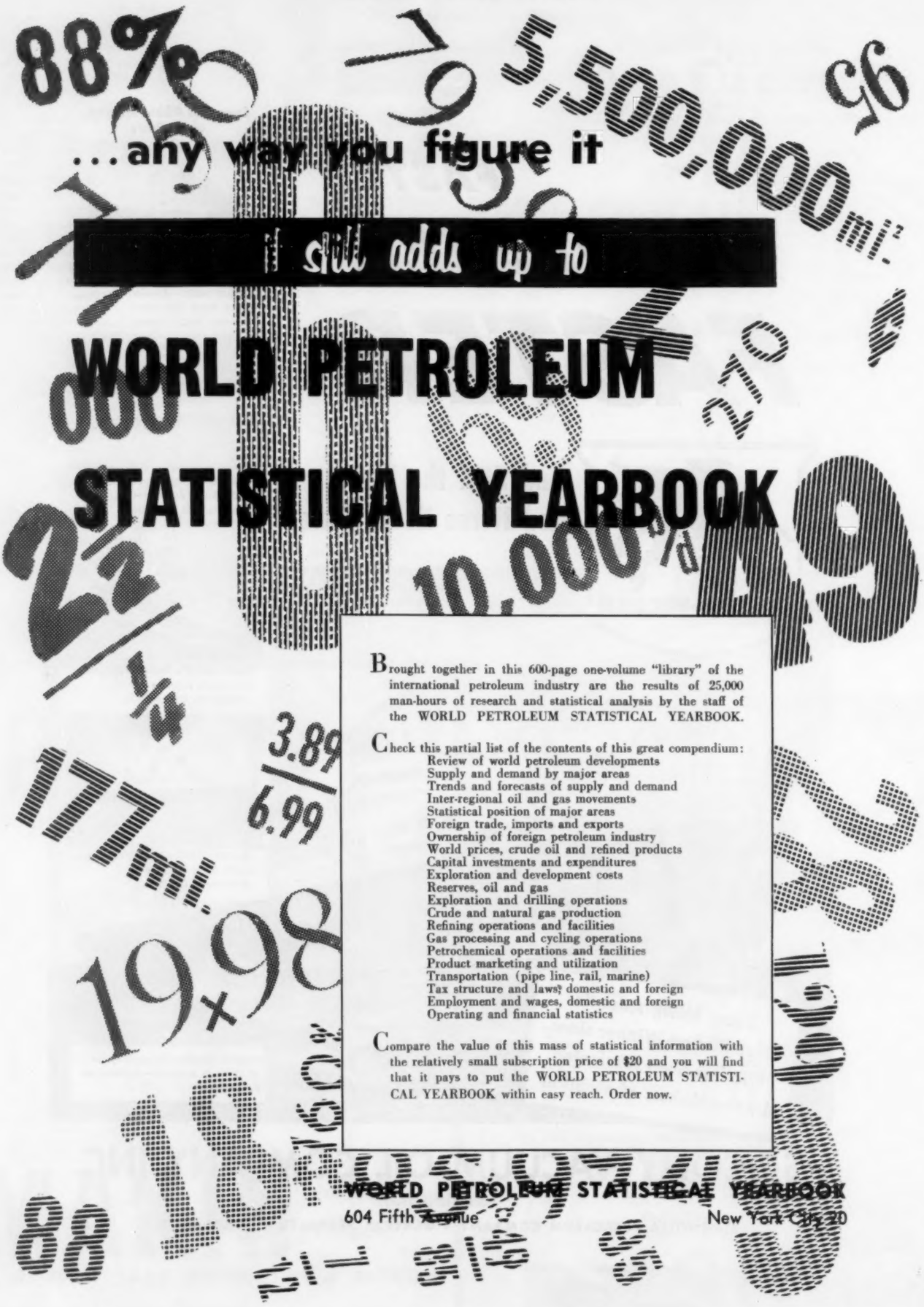

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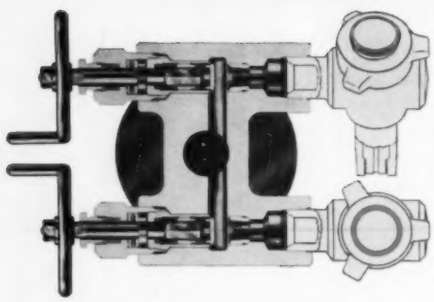

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